THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. FEBRUARY 27, 1890. CHICAGO, ILL. NUMBER 9.

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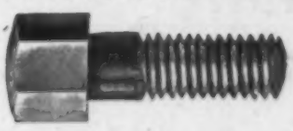

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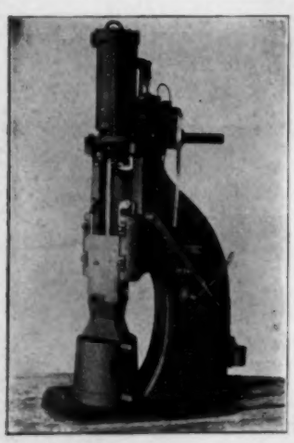

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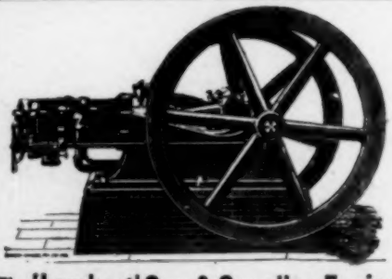

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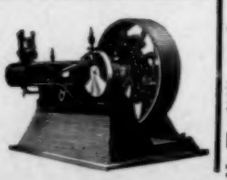

THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. FEBRUARY 27, 1896. CHICAGO, ILL. NUMBER 9.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The situation in iron and steel at the end of February, is in some respects similar to that of a year ago—increasing stocks of pig iron, an unsatisfactory volume of business in raw and finished materials, with mill capacity only partly employed, collections difficult, commercial loans restricted, and a general absence of data on which to base an estimate of the future. Two elements are found in the present situation that were absent a year ago—a general disposition to hold prices substantially where they are and a belief that within another month developments will justify present confidence in a fair volume of business for 1896. It is recalled that it was not until later March and early April of 1895 that buying started, in any significant way, and while the very fact of last year's boom, with its disagreeable sequel, is considered sufficient guaranty against its recurrence, there is a feeling of confidence, in spite of present conditions, that demand will be materially stronger as the year advances. Railroads continue to be the most important factor in current buying. Additional rail orders have been placed in the past week and each week is adding its quota of car-shop work. A total of nearly 100,000 tons of rails on the books of the Chicago interest is nearly 100 per cent beyond the record of a year ago. Pittsburg and farther Eastern mills have booked a good tonnage also, in February; but deliveries are such that this rail business is not likely to work any early improvement in the Bessemer iron and billet markets. In neither metal has the week brought any business worthy of mention. From one or two furnaces in the valley some Bessemer for early shipment has been sold at the equivalent of $13.15, Pittsburg, but Pittsburg middlemen have shaded $12.75, Pittsburg, in the little business they have handled. Pig iron stocks of Pittsburg steel works have been reduced somewhat in February, and they are likely to be buyers in March. Steel is weaker. Pittsburg sellers hold for $17.75 on business involving May deliveries; yet some March and April steel has sold at $17.50 at mill. Chicago has done a good business in rods the past week, with a total of 16,000 tons, and there are other signs of a better movement in wire and wire nails. Bars for car works have shown some activity, but the bar mill capacity is scarcely half employed as yet, a fact that has aided not a little in the determined movement of that interest for fair prices and an allotment of tonnage. Engineering and other heavy-work foundries do not get new business in the way they would like and their purchases of iron continue restricted. On Southern foundry irons there has been further cutting by smaller producers, and there are evidences of a severe strain upon the resolution of the leading companies to hold to $8.50 Birmingham for No. 2 foundry. Northern producers in general keep quotations up on 50-ton and 100-ton business, but the occasional buyer of 500 to 1,000 tons gets a concession.

THE CLEVELAND DISTRICT.

While March is the month in which it has been assumed that something definite will develop as to iron ore prices for 1896, it is plain that the condition of the market will decide rather than the calendar. There is no more indication to-day of a beginning of negotiations than existed two months ago. Nearly every sales office has done some business in the past few weeks, several consumers requiring lots ranging from 5,000 to 15,000, to carry them into May. In these sales Bessemer ores have brought about $1 a ton above last year's prices. On non-Bessemers prices for the year are expected to be enough higher than those of early '95 to cover higher labor cost and higher freight and a margin of profit that was wanting on early sales last year. On non-Bessemer ores of which there is never any over supply—those desirable in foundry mixtures because of the phosphorus they carry, counteracting the tendency of other ores to red-shortness—no trouble is anticipated in getting a fair price. Some talk about freights is heard, and while it is quite certain charters could be made at 95 cents, Marquette, and $1.10 from the head of the lake, these figures are a little above what shippers are willing to take chances on, with ore prices still undetermined.

Pig Iron. The wait goes on, with no attempt by producers of Bessemer pig to stimulate business by offering concessions. Some metal has gone from valley furnaces in the past two or three weeks at a cut of 50 cents below the $13 mark at which the majority of furnacemen stand, but it was for early delivery. One sale of 2,000 tons is reported at $12.40 in the valley. The announcement that the $2 coke price will continue through March disproves any present intention, at least, of such a drop in coke as would have a depressing tendency on the ore market. Furnacemen are confirmed in their position by the decrease in stocks of Bessemer iron in the hands of large steel makers and the expectation that some purchases will be made by Pittsburg interests in the coming month. Some small sales of foundry iron have been made in this market the past week. On small-lot business, $13 and $12.50 in the valley are the figures for No. 1 and No. 2 strong iron, respectively. Some sales of No. 2 Scotch iron, and of cinder-mixed iron have been made at $12. Forge iron is in fair demand, with little to be found in the valleys. The quotation is $11.25 to $11.75, Cleveland. Lake Superior charcoal is $14 to $14.50.

Finished Material. There is little to report under this head outside of railroad business. Recent rail purchases for lines traversing the Central West include an additional 10,000 tons (making a total of 40,000) for the Pennsylvania and 13,000 tons for the Lake shore. A 5,000-ton order for the Nickel Plate and 2,500 tons for the new Lake Superior & Ishpeming line are pending. A feature of one recent car order is that steel axles were specified, where iron has been called for exclusively heretofore. In the absence of demand for plates, structural material, bars, etc., there is no noticeable weakening in prices. Tank plates are kept at 1.35c, Pittsburg, though on light plates some business has been taken at a Cleveland price of 1.34c. Beams and channels are 1.49c, Cleveland, bar steel 1.24c to 1.29c, bar iron 1.25c. Some building is in prospect and plans now prepared call for about 2,000 tons of steel. Old material is dull. The former basis of $16.50 for old iron rails, $12 to $12.50 for No. 1 wrought scrap, $12.50 for old steel rails, $13 for old wheels and $8.50 for wrought turnings, rules.

THE CHICAGO DISTRICT.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

General conditions are rather better than a week ago, and in a few branches of the market sales are of larger tonnage. Local mills and furnaces report a good demand for their products, and in fact they seem to be doing rather better than outside concerns. The local steel company made large sales of rods last week, aggregating about 16,000 tons, at $28. Wire and nail mills are expected to move their large stocks within the next 30 days, and in case they do a larger inquiry for both billets and rods will be had, with probably higher prices. The local mills in anticipation of this, are not anxious to make heavy sales, preferring to wait for higher values. Contracts for pig iron made last week were larger than those of the previous week, the greater portion being for Northern irons. The Calumet furnace, through inability to dispose of its stock, went out of blast last week, Wednesday, and will remain out for an indefinite time—probably until better prices are assured. Structural material is in growing demand. No large contracts were closed last week, but the call for small lots is on the increase and a number of good orders were closed. Several large contracts that have been hanging fire for some time will probably be awarded in the near future. Reports from the smaller foundries and machine shops indicate that business is good with them, and the large implement manufacturers are preparing for large trade this season.

PIG IRON.—Local furnaces made larger sales of iron last week than in the week before, and as a number of buyers are still in the market the present week is expected to make a good showing. Quotations are being maintained very well, no concessions being made from those given below except on large lots for nearby delivery. Buyers seem to have come to the conclusion that the recent drop in prices brought them as near to bottom as possible, and appear willing to pay these figures. In Southern iron the market has been quiet, the largest sale being for 1,000 tons, and nearly all of them for lots of 100 tons or less. Inquiries in the market aggregate from 8,000 to 10,000 tons, and a large part of these will probably be closed soon. The larger Southern producers claim to be holding prices above those quoted, but these figures are being made freely by smaller furnaces, anxious for business. These same smaller furnaces appear to be getting their full share of the business going. The range of quotations is represented as nearly as possible below:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$11 60@12 10
Local Coke Fdy. No. 1	12 75@13 25	South'n Silveries No. 1	12 75@13 00
Local Coke Fdy. No. 2	12 25@12 75	South'n Silveries No. 2	12 25@12 75
Local Coke Fdy. No. 3	11 25@11 75	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	12 75@13 25	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	12 25@12 75	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	11 25@11 75	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 1	12 60@12 85	Alabama Car Wheel	17 50@18 00
South'n Coke No. 2	12 10@12 60	Malleable Bessemer	13 75@14 00
South'n Coke No. 3	11 60@12 10	Coke Bessemer	13 75@14 00
Southern No. 1 Soft	12 10@12 60		

BARS.—Car works have taken considerable iron in the week, and further orders from this source are expected General business is in good shape. Quotations are unchanged at 1.35c for common iron, 1.40c to 1.45c for guaranteed, and 1.40c to 1.45c for soft steel bars from strictly billet stock.

RAILS AND TRACK SUPPLIES.—Orders for small lots continue to be frequent, but no large contracts have been closed as yet. Quotations are unchanged as follows: Rails, $29 and up; splice bars, 1.65c to 1.75c; track bolts, 2.25c to 2.45c; spikes, 1.85c to 1.90c.

BILLETS AND RODS.—The local mills sold about 16,000 tons of rods last week, at $28, Chicago. It is expected that a large demand for both rods and billets with correspondingly higher prices, will come up as soon as the wire and nail mills dispose of some of their surplus stock. This, it is thought, will be in the near future. Consequently, the officials of the steel company are feeling confident of the future, and are not disposed to make larger sales than is necessary now, preferring to wait for higher values. Billets, of which only small sales were made last week, are quoted at $20.

STRUCTURAL MATERIAL.—While no very large contracts were closed last week, general business continues to improve, and the outlook is bettering all the time. A number of building schemes that have been hanging fire for some time are expected to materialize in the near future. Prices are unchanged as follows: Beams and channels, 1.65c to 1.75c; angles, 1.50c to 1.55c; plates, 1.60c to 1.65c; tees, 1.65c to 1.75c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—The demand has been fair and a number of good sales were closed last week. Quotations are firm and are made as follows: Tank steel, 1.60c to 1.65c; flange steel, 1.85c to 1.90c; fire-box steel, 2.85c to 5c; boiler tubes, 60 to 65 per cent discount.

MERCHANT STEEL.—A good business has been done by local dealers both in mill lots and from store. Prices are maintained as follows: Open-hearth spring, tire and machinery steel, 2c to 2.10c; smooth finished machinery steel, 1.75c to 1.80c; smooth finished tire 1.65c to 1.70c; tool steel, 5 50c to 7.50c; specials, 11c and upwards; Bessemer bars, 1.55c to 1.65c.

SHEETS.—Business continues good, and dealers are more and more inclined to be stiff in their views. Only a few of them are quoting at less than 75 and 10 and 5 for galvanized, and 2 40c for No. 27 black, but in a few instances prices have been made at 80 per cent discount for galvanized and 2.30c for black.

OLD RAILS AND WHEELS.—The market has been quiet, interest centering in old wheels, for which there is a large demand, 500 being sold last week at $14, and other sales made at $14 to $14.50. Old iron rails $11 to $12.

SCRAP.—Dealers are less inclined to take a hopeful view of the situation, and report only small sales. The following are buying quotations furnished by dealers: Railroad forge, $10.50 to $11; dealer's forge, $10; No. 1 mill, $6; railroad cast, gross ton, $9.50 to $10; machinery cast, $10 to $11; axles, $13; cast borings, $4; wrought turnings, $5; axle turnings, $5.75; mixed steel, $9; stove plates, $4; heavy melting steel, $10.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Buffalo. The pig iron market in this vicinlty continues quite active for this time of the year. While there seems to be an absence of the usual run of carload orders for quick delivery, which probably indicates that consumption among the smaller csnsumers is not as heavy as for some little time past, yet several of the larger consumers of foundry iron have closed in the week for large amounts for delivery as far into the future as the furnaces interested would accept. Northern furnaces are firm at present prices, and it is quite evident that many of them would prefer to shut down rather than sell for less than they are now receiving. There is some evidence of Southern sellers weakening a trifle and concessions are being made on iron for immediate shipment from the South. We continue to quote $13 to $13.50 for No. 1 strong foundry; $12.75 for Southern soft No. 1, $13.50 for Ohio strong softeners, and $14 to $15 for Lake Superior charcoal.

Cincinnati. Orders have been placed quite freely for pig iron, but mostly for limited quantities and quick delivery. Very few sales have been made of 500 to 1,000 ton lots. In the territory tributary to Cincinnati, buyers with one or two exceptions are exhibiting little interest in the market. Although users of iron are as a rule hopeful of the future, many of them have not much work really in hand, and are not disposed to purchase until it is ascertained just what quantity will be needed. One of the hopeful features of the situation is that quite recently orders for cars amounting to 6,800 have been placed by the Erie, Lake Shore, New York Central and Pittsburg & Lake Erie Railroads. There is no change in prices. The leading Southern furnaces are maintaining their figures firmly, and the special concessions are being made by those whose financial needs make it necessary to move their iron as fast as it is produced. Reports from various parts of the country show that numerous large buyers are testing the market, and it is believed that March will develop more interest and a heavier demand. Collections are better, and although there is a greater proportion of failures than usual, there have been but few in which sellers of pig iron were losers.

Guarantors' Liability Indemnity Co.

The recent publication of the annual statement of the Guarantors' Liability Indemnity Co., of Philadelphia, a copy of which is given in another part of this paper, has reinforced the claims it has been making in general terms, as to its stability and the rapid growth of its business among manufacturers. It is claimed, and on evidence that appears conclusive, that the experimental stage of liability insurance has been passed, and that experience has been sufficient to afford a basis of averages, on which to schedule the valuation of risks. Every policy issued by the Guarantors contains a limitation as to the possible loss it can sustain and limits such loss to the positive question of liability. Thus, unlike fire, marine, or life insurance there is no opportunity for enormous losses.

The most important class of risks which the Guarantors' takes from its policy holders, is that of "employer's liability." The payment of premiums relieves the employer of all liability for damages resulting from accidents in which employees are injured. All risk and worry on this account are transferred from the insured to the insuring company. There is also a public liability protection, in the plan of the Guarantors'. In case of injury caused to a non-employe by workmen, teams or machinery of the employer, the policy protects the latter against liability. Steam boiler insurance is also written, this being a large feature of the Guarantors' business. The financial statement of the company, and the opinions of Central Western manufacturers who have done business with it are given at some length in other columns.

Geo. G. Brown, district manager for the Guarantors, has lately closed with the following firms for their liability and boiler insurance, and reports a good general business in his line: The Ohio Steel Co., Youngstown Steel Co. and Mahoning Valley Iron Co., Youngstown, O.; HP Nail Co., and King Bridge Co., Cleveland; Youngstown Ice Co., Youngstown. Mr. Brown has lately secured the service of Mr. H. F. Cook as chief inspector for the Guarantors in his district, which has Cleveland as its headquarters. Mr. Cook's abilities as an expert inspector are well known.

AFFIDAVITS of J. W. Wright, superintendent, and George W. Kohlmetz, secretary, of the Gobeille Pattern Co., appear in a recent publication of that company, to the effect that its business from Aug 1, '95, to Feb. 1, '96, was larger than for any similar period in its history.

THE foundry of the Kurtz & Buhrer Foundry Co., Chicago, was destroyed by fire Feb. 25, with a loss put at upward of $100,000. The amount of insurance is not stated in the dispatches.

OBITUARY.

AMBROSE PLAMONDON.

Ambrose Plamondon, president of the Plamondon Mfg. Co., of Chicago, died at his home in that city Wednesday, Feb. 19, of a pulmonary affection. Mr. Plamondon had been ill for several weeks, and had recently returned from the South. He was born in Quebec, 62 years ago, removing from there to Oswego, N. Y., in early life. Later he moved to Ottawa, Ill., and after a few years to Chigago, where he founded the company which bears his name. Mr. Plamondon leaves a wife and five children, of whom Chas. A. Plamondon is vice-president and George Plamondon is secretary and treasurer of the Plamondon Mfg. Co., and A. D. Plamondon is manager of the Saladin system of malting.

EDWARD B. HOLMES.

Edward B. Holmes, of Holmes, Pyott & Co., iron founders, of Chicago, died at his residence in Chicago, Thursday, Feb. 20, of paralysis. Mr. Holmes was born at Chittenango, N. Y., 67 years ago. In his 13th year he moved to Racine, Wis., and three years later to Chicago, where he secured a position as molder in the Gates Iron Works. Several years later, in company with James M. Pyott, he started an iron foundry under the name of Holmes, Pyott & Co. For some years both Mr. Holmes and his partner worked with their employers in the foundry, but the business later grew to such dimensions that they had to confine themselves solely to the management. The first work which brought the firm into prominence was a commission from the Northwestern Railway to furnish all castings for that company. The rapid growth of the firm, however, dates from 1865, when architectural iron work was made a special feature. At present about 100 men are employed, and the annual amount of business done is upward of $250,000. During the last years of his life Mr. Holmes retired from active business, leaving his sons in charge.

HART A. MASSEY.

The head of the well known implement manufacturing firm, the Massey Mfg. Co., of Toronto, Ont., died in that city Feb. 20, aged 73. He began the manufacture of harvesting machinery in 1852 and in 1879 the establishment was removed from Newcastle, Ont., to Toronto. In 1871, Mr. Massey, owing to ill health, resigned the active management to his eldest son Chas. A. Massey, then only 23 years old. Later the father resumed his duties as manager. The establishment has grown to be one of the most important of Canadian industries. For a few years following 1871, Mr. Massey had his residence in Cleveland. He distributed in the last few years of his life about $300,000 among educational, philanthropic and religious institutions.

IRVING B. SMITH.

Irving B. Smith, managing proprietor of the *Marine Record*, of Cleveland, died at Chicago, Feb. 17, of consumption. He had been in poor health for several years and at times was compelled to give up active supervision of his business. His business abilities were evident in the upbuilding of his paper and those associated with him have reason to regret deeply his untimely death.

JOHN T. ROCKAFELLOW.

One of the old time foundrymen of Chicago, died there Feb. 20, 1896—John T. Rockafellow, who was born Feb. 1, 1838, in Livingston Co., New York, and at 17 learned the molder's trade. In 1870 he went to Chicago, built a large foundry for John J. McArthur, and managed it for several years, later becoming connected with the Crane Co. Moving to Maywood, Ill., in 1878, he erected the plant now known as the Maywood Foundry Works, of which he was proprietor at the time of his death.

B. P. CRANE & Co., exclusive sales agents for the Irondale Steel & Iron Co., manufacturers of tin and terne plates, at Middletown, Ind., and for the Acme Metal Co., manufacturers of anti-friction metals and brass castings, Chicago, have removed their office from The Rookery to room 425 Home Insurance Bldg., Chicago.

IN the week preceding the recent shut-down, the output of the Ohio Steel Co., Youngstown, O., for one day was 1,252 tons, the best record it has yet made.

THE IRON TRADE REVIEW

DEVOTED TO

IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

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FEBRUARY 27, 1896.

A DAY OF FOUNDRY PROGRESS.

The notable fact about foundry operations in the United States in the past three years is the unusual amount of attention that has been given to the study of the chemistry and the physics of cast iron. This statement has been elaborated upon heretofore, in various connections, in demonstration of the utility of organizations among foundrymen, devoted to research and discussion in technical fields. But there is accumulating evidence of a stirring among investigators, unlike anything that has yet been witnessed. The present wave of investigation, starting with a discussion in the foundrymen's associations, East and West, on the relation between the chemical content and the physical properties of cast iron, drifted into a controversy as to the form of test-bar that will most accurately reveal the strength and shrinkage of the casting. The test-bar question was given such prominence that the American Society of Mechanical Engineers took it up, appointing a testing committee, which has made experiments covering a wide range, both as to the size of test-bars employed and as to the grade of irons and the uses for which the castings are intended. A partial report has been made, the most noteworthy feature of which was the data concerning cooling curves and the three expansions of iron solidifying in a mold, presented at the Detroit meeting of the A. S. M. E., last year.

Meantime the discussion was taken up by the American Institute of Mining Engineers, on the broad lines suggested in the scheme of inquiry presented at the Florida meeting of the Institute last March. The fruit of the investigations set on foot among the membership of that splendid organization appeared in part at last week's meeting in Pittsburg. It is a significant fact that this last campaign has brought to light the results of investigations that until now have been under the lock and key of the companies undertaking them. Mr. Outerbridge's interesting and valuable paper on "molecular annealing," for example, makes public for the first time the results of experiments, quietly conducted, covering an interval of 15 years. Mr. Webster's brief contribution, printed elsewhere, shows that six years before the Detroit meeting, at which the theory of three expansions was advanced, Mr. John R. Whitney found, with a certain brand of iron, that two expansions occurred in cooling, and that with another iron there was one expansion. And Mr. Whitney, in turn, had for his predecessors Messrs. Wrightson and Markham, whose experiments in England had been published nearly 10 years before.

An important point suggested in Mr. Webster's paper is that recent investigations in the United States, in this field, have stopped with the testimony given by the ends of a cooling test bar, ignoring the other two dimensions, and thus give us as yet no data as to any changes that may be taking place in the volume of the casting. Mr. West's paper was of particular interest to heavy founders and those making a specialty of chilled castings, and was important in calling attention to the grade of the iron as a prime element in determining its behavior in cooling.

Because it has brought out data that have gone unpublished heretofore, and because it calls attention to considerations overlooked in recent investigations, we regard the Pittsburg discussion as in some respects the most important of the entire investigation. And we shall look to see a new stimulus to investigation, as a result of it, and a nearer approach to reliability and uniformity in results than investigators have yet been able to attain.

Youngstown Honors Andrew Carnegie.

The Youngstown, O., Board of Commerce gracefully and promptly followed up the episode of last week in the Cleveland Chamber of Commerce, by holding a called meeting, attended by a goodly proportion of its membership, and unanimously electing Andrew Carnegie an honorary member. The iron interests of the Mahoning Valley were very largely represented in the meeting. The resolutions are as follows:

"*Resolved*, By the Youngstown Board of Commerce, that Andrew Carnegie be elected an honorary member of this body."

"*Resolved*, That we recognize in Andrew Carnegie a public benefactor in the widest sense, and that he is a living, shining example to his brother millionaires."

"*Resolved*, That Mr. Carnegie has largely benefited the manufacturers of Youngstown, its laboring population and its people generally by his large and continuous purchase of Mahoning Valley products—pig iron, limestone and iron ore—extending over a period of a quarter of a century.

"*Resolved*, that a copy of these resolutions be sent to Mr. Carnegie with the compliments and good wishes of Youngstown and the Mahoning Valley."

ELECTRO-MAGNETS as lifting agents in connection with cranes came into use several years ago, though, on the whole, their employment in this way has been comparatively restricted. In one of the large English foundries—at Sandycroft—however, they are now again applied to that purpose, and in sizes which permit of readily lifting, by their means, weights of as much as two tons. The magnets are attached to a crane, and take a current of about 5 1-2 amperes, at 110 volts, the current supply being controlled by a switch. Some measure of the service gained from these magnets may be obtained from the statement that with one of them three men can do in about fifteen minutes the work which previously occupied twice as many men for about an hour and a half.—[From Cassier's Magazine for March.

ABILITY to give close regulation is not the only essential in a first-class governor; in fact, it is beginning to be realized that it is the one easiest of attainment. Strength to resist the growing infirmities of age is also an essential, and one far harder to secure. Any builder of high-grade automatic engines can guarantee extremely close regulation; but few can furnish a governor whose useful life will bear any reasonable proportion to that of the other working parts of the engine. It has taken time, years of service and rough usage, to point out the weaknesses that the earlier designers did not foresee. Only within a very recent period have the demands of the electrical industries taken definite form and come to be fully and clearly understood. In fact, we may safely say that it is only now, with the mistakes of the past and the demands of the present both set clearly before us, that we are able with certainty to designate the qualities that distinguish the governor that is not a weak spot in a modern high-speed engine.—[E. T. Adams in Cassier's Magazine for March.

SELLING OF PIG IRON ON ANALYSIS.*

BY C. R. BAIRD & CO.

Referring to your inquiry as to the requests of our customers for analyses of pig iron, we beg to say that until the past few years very little attention was paid to the chemical constituents, and founders generally believed that it was necessary to use No. 1 X foundry iron for the manufacture of small castings, where softness and fluidity were essential. The quality and fitness of iron for this purpose was judged by the appearance of the fracture, and very large crystals were especially prized. An open-grained, soft iron covered their requirements. In larger machinery castings, No. 2 X foundry was mixed with No. 1 X, or, in many cases, used alone. It was classified as "somewhat closer and harder than No. 1 X," and was not as valuable as the former, because the crystals were smaller. The next grade in price was No. 2 plain foundry, which was still closer in grain, and was used only for the heaviest and cheapest class of castings, or as a filler in connection with the higher grades. The light-colored, weak, high-silicon iron, made occasionally by every furnace, was regarded as poor stuff and utterly worthless for castings requiring strength and good finishing qualities. The founder depended absolutely upon the size of the crystals and the color of the fracture, and if the iron looked all right, would, with no other guide, boldly attempt the manufacture of any kind of castings, even for the most difficult and expensive machinery, where defective castings might cause enormous loss. That such a state of affairs could have existed for years seems almost incredible, but no one will deny that such was the case. Recently, the greater knowledge of the effect of the chemical constituents of iron has been of immense advantage to founders; and this subject is now regarded as of the utmost importance. The influence of silicon is now commonly understood; but although other elements are entitled to almost equal recognition, they rarely receive it. It has been claimed that the appearance of the fracture, together with a knowledge of the amount of silicon present, is all that the founder requires to produce good results. This is, of course, better than the old method, where even the amount of silicon was unknown; but we find that the most progressive founders recognize the importance of the other elements, and request complete analyses. The *consensus* of opinion of these customers is as follows:

Elements.	Proportions Required.				
	I.	II.	III.	IV.	V.
	Per cent.	Per cent.	Per cent	Per cent.	Per cent.
Graphitic carbon	3.20	3.30	2.90	3.00	3.00
Combined "	0.30	0.20	0.40	0.30	0.30
Silicon	2.75	3.00	2.40	2.00	2.50
Phosphorus	0.60	0.80	0.60	0.80	0.90
Manganese	0.60	0.50	0.60	0.50	0.30
Sulphur	0.015	0.01	0.02	0.015	0.02

I.—No. 1 X foundry, for the manufacture of pulleys, small machinery-castings, etc.

II.—No. 1 X foundry, for carrying harder pig-iron or scrap, and for making choice light hardware-castings, etc.

III.—No. 2 X foundry, for heavy machinery-castings, etc.

IV.—No. 2 X foundry, for carrying harder iron, and for light machinery-castings, stove-plate, etc.

V.—No. 2, plain foundry.

There is a wide variation in the specification for the last grade, which is more frequently sold without guaranty than any other. Many furnaces throw indiscriminately into the class of No. 2 plain all iron that by fracture will not grade as No. 1 X or No. 2 X, and is too open and soft for forge purposes. By these furnacemen and by founders in general, it is regarded as an inferior iron, to be used with caution; consequently the price is low, and it is often possible to obtain very valuable iron classified as No. 2 plain; but it is probable that this grade will vary largely, unless graded by analysis. The largest consumer of No. 2 plain in this region calls for the analysis shown in column V above, and is able to meet his requirements at a low cost; but this is at the expense of other consumers, who do not specify analysis, and consequently get lower carbon and lower silicon, which is only the average run of No. 2 plain iron. You, of course, realize the necessity of great variation in the specifications of the different elements in iron for widely different purposes. Where low-grade pig iron or scrap can be secured at a low price, many use a large percentage of the same in connection with iron containing as high as 12 per cent. of silicon, with most satisfactory results. Where great fluidity is especially required, regardless of strength, iron very high in phosphorus is called for, etc. Owing to the fact that we handle the output of twenty-six furnaces, which produce all descriptions of pig iron, and that we are very frequently obliged to furnish complete mixtures for various classes of castings, we have recently established our private laboratory, in charge of a competent chemist, and now make mixtures, and combine these widely different irons entirely by analysis. We gladly furnish, free of charge, a complete guaranteed analysis of not only our own brands, but of any pig iron, castings or coke that founders may send us. We find this method by far the most accurate and satisfactory way of ascertaining the value of the different grades, and we think the subject is worthy of the most careful attention of all melters of iron. In this connection, we beg to say that if we can be of any assistance to them it will give us great pleasure to place our laboratory at their disposal.

* Response to a letter from Wm. R. Webster, asking C. R. Baird & Co. to give the results of their experience in selling pig iron on analysis. Presented at the Pittsburg meeting of the American Institute of Mining Engineers, Feb. 20, as part of the discussion on "The Physics of Cast Iron."

BESSEMER INGOTS AND RAILS IN 1895.

The statistics of production of Bessemer steel ingots and rails, in the United States in 1895 are given in the current issue of the *Bulletin*, as gathered by General Manager Swank, of the American Iron and Steel Association. The rail statistics do not include the comparatively small quantity of standard rails which were made by manufacturers from purchased blooms. In the statistics of ingots produced are included the production of the few Clapp-Griffiths and Robert Bessemer plants, and also the production of all steel castings by all Bessemer works.

The total production of Bessemer steel ingots in 1895 was 4,909,128 gross tons, against 3,571,313 gross tons in 1894, an increase of over 37 per cent. The production in 1895 was much the largest in our Bessemer steel history. The following table gives our production of Bessemer steel ingots in the last nine years in gross tons:

Years.		Years.		Years.	
1887	2,936,033	1890	5,688,871	1893	3,215,686
1888	2,511 161	1891	3.248,417	1894	3,571,313
1889	2,930,204	1892	4 168,435	1895	4,909,128

With an estimated production in 1895 of over 1,000,000 tons of open-hearth steel, it is probable that the total production of steel in that year exceeded 6,000,000 tons. Great Britain's total steel production has never amounted to 4,000,000 tons in any year.

The following table gives the production of Bessemer steel ingots by States in 1892, 1893, 1894 and 1895.

States—Ingots.	1892. Gross tons.	1893. Gross tons.	1894. Gross tons.	1895. Gross tons.
Pennsylvania	2,397,983	2,126,220	2,334,548	2,978,924
Illinois	879 952	314,829	581,540	866,531
Ohio	409.855	348,141	363,974	719,954
Other states	480,644	426,496	291 251	343,719
Total	4,168,435	3,215,686	3,571,313	4,909,128

The production of all kinds of Bessemer steel rails by the producers of Bessemer steel ingots in 1895 was 1,266,081 tons, against a similar production of 904,020 tons in 1894, 1,036,353 tons in 1893, and 1,458,732 tons in 1892. The following table shows the production by States of Bessemer steel rails by the producers of Bessemer steel ingots in 1892, 1893, 1894 and 1895.

States—Rails.	1892. Gross tons.	1893. Gross tons.	1894. Gross tons.	1895. Gross tons.
Pennsylvania	885 652	639 431	606,866	837.043
Illinois	450,542	232,260	225,869	324,050
Other States	122,538	164,662	71,285	104,988
Total	1,458,732	1,036,353	904,020	1,266,081

Manager Swank states that when the production of rails in 1895, from purchased blooms, is added to the above, it is probable that the total for the year will be found to exceed 1,350,000 tons, or within 100,000 tons of 1892.

AMERICAN INSTITUTE OF MINING ENGINEERS.

The meeting of the American Institute of Mining Engineers, which opened in Pittsburg, Tuesday evening, February 18, and continued through Wednesday, Thursday and Friday, was regarded by old members as one of the most profitable in the history of the Institute. The local committee, both in its excursions to the great establishments that make Pittsburg so attractive a meeting place, and in its arrangements for the comfort and convenience of the members, succeeded admirably in all that it set out to do, and the meeting, in more than one respect, was made one to be remembered. The registration of members ran up to 150, and counting guests, more than 200 attended. The sessions were held at the Monongahela House, which was the scene also of the banquet, on Thursday evening. The attendance of blast furnacemen of the Central West was large, in view of the ease of reaching Pittsburg and of the fact that an appointment had been made by the representatives of important interests allied with blast furnace work, for a special gathering on Monday evening. One question that had as much consideration as any other in the interchange of professional talk that accompanies such meetings, is that connected with coke manufacture by the retort system, in its relation to the immediate future of blast furnace operations. Private excursions were made to recently installed plants of the Otto Hoffman and the Semet-Solvay systems, and furnacemen who did not take these trips were given a chance to see, at the Monongahela House, the results of recent tests with Connellsville, Pocahontas and Pittsburg coals, in connection with the saving of the valuable products of liberated gases.

At the opening session of the Institute, on Tuesday evening, was presented the valuable paper of President Weeks, enforcing the claim of the late Wm. Kelly, of Pittsburg, to priority in the discovery of the Bessemer process—at least so much of it as is involved in the decarburization of iron by blasts of air. This was referred to briefly in our last issue.

Wednesday's forenoon and afternoon programme consisted of excursions to the Homestead and Edgar Thomson works of the Carnegie Steel Co., Ltd., and to the Westinghouse Electric & Mfg. Co.'s plant, at East Pittsburg. At Homestead, an armor plate for the Oregon was forged before the visitors, and at Edgar Thomson the rolling of rails was seen. Geo. Westinghouse, Jr., conducted the party about the mammoth East Pittsburg works. The new Baldwin-Westinghouse electric locomotive was shown and operated, and the new traction system was explained. At the evening session of the Institute, at the Monongahela House, Thos. Robins, of New York, read a paper entitled "Notes on Conveying Belts and Their Uses;" Guy R. Johnson, of Embreeville, Tenn., one on "The Embreeville Estate of Tennessee;" R. H. Richards, of Boston School of Technology, one on "Experiments in Sorting before Sizing." H. A. J. Wilkens, of South Bethlehem, Pa., treated of "The Magnetic Separation of Non-Magnetic Material," and H. L. Hollis, of Chicago, presented "Notes on the Walrand-Legenisel Steel Casting Process." A liberal synopsis of Mr. Hollis's paper is printed elsewhere. In connection with the reading, he presented some specimens of the work done with this process at Chicago.

Discussion on the Physics of Cast Iron.

The special assignment for Thursday was the continuation of the discussion begun at the Florida meeting, last year, on "The Physics of Cast Iron." Previous to the opening of the discussion, however, Mr. A. J. Rossi, of New York, in connection with his printed paper on "The Effect of Additions of Titaniferous to Phosphoric Iron Ores in the Blast Furnace," made some remarks, and exhibited some specimens. His conclusion, from the experiments referred to, is that while titanium in an iron ore (at least under the conditions observed in smelting these ores hitherto) has a tendency to throw the carbon in the metal into the combined state, the presence of a considerable amount of phosphorus simultaneously with titanium, in a mixture, modifies the conditions of existence of the carbon to the extent of throwing it almost all into the graphitic state, this effect being the greater the more phosphoric the mixture, and the greater the proportion of titaniferous ores used.

In introducing the discussion on cast iron, Dr. Raymond read, in some cases by title, and in others in full, contributions sent in since the Florida meeting. Noteworthy among these was a paper by Alex. E. Outerbridge, Jr., of Philadelphia, on

"The Mobility of Molecules of Cast Iron."

The writer asserted that experience disproves the commonly accepted belief as to the effect of vibration on the molecular structure of cast and wrought iron. Upwards of 1000 tests he had made went to show that within limits cast iron is materially strengthened by subjecting it to repeated shocks or blows. These demonstrated that the molecules of cast iron can rearrange themselves at ordinary temperatures, and that thus strains in the castings are relieved—a molecular annealing producing similar results to those secured in the slow cooling after the high temperature of the annealing oven. In 1883, the conclusion was recorded, in connection with experiments at the works of A. Whitney & Sons, that chilled cast-iron car wheels rarely cracked after being in service for a considerable time; that if they did not crack when new, they were likely to last without cracks for a long time. It was noticed by the writer that 1-inch square test bars, 15 inches long, after being cleaned in a tumbling-barrel showed considerably greater strength than ordinary castings from the same pouring. The average of repeated tests, taking six square bars out of 12 cast at the same time, and cleaning them in the tumbling-barrel, and cleaning the remaining six with a wire brush, showed that the tumbled bars were from 10 to 15 per cent stronger than the others. Round test bars were then taken, and the same results noted. Then six bars were taken, and subjected to 3000 taps on one end. All showed a gain in strength over six companion bars put through the tumbling-barrel. Another fact discovered was that strain resulting from cooling exists even in the smallest casting. Repeated tests showed that ½-inch bars are subject to the same law.

It was found that the difference in transverse strength between bars struck on the end and those not, depends on the number and strength of the blows. A greater difference between bars subjected to taps and those not so treated, exists in hard irons than in soft irons. There is a greater relative difference between ½″ bars and 1″ bars, and a still greater difference between 2″ and 1″, strains being greater in the larger bars.

Impact tests were made, using a 14-lb. weight for 1″ bars. It has always been maintained, in connection with such tests, that each blow further weakens the casting and that the final fracture represents the cumulative effect of the blows. As applied to impact machines and to unannealed bars, this is fallacious. In the tests made, six bars were taken and the drop gauged so that a single blow broke them. Then six companion bars were taken and subjected to a drop of half the distance, with the same weight. The second drop was then made, the full distance, but failed to break them. Four, six, eight and in one case 15 blows were required before the bar broke. It was found that from five to 20 blows were required to break bars put through tumbling barrels and thus molecularly annealed.

All the tests made in investigations extending over 15 years corroborated the general statement. Molecular annealing of cold cast iron by successive slight shocks differs, however, from ordinary annealing in that it has no power to change the condition of carbon or the chemical composition. In conclusion the writer made several deductions from his experiments which are, in substance: Housings, mortars, guns and other castings, which must stand heavy shocks in practice, should never be suddenly subjected, in testing, to anything approaching the strain to which they will be subjected in practice. Old castings are more reliable than new ones. Moderate shocks tend to relieve internal strains. Strong iron castings, or castings of irregular shape, have greater internal strains than castings from soft iron. The largest gain in strength in bars subjected to moderate blows, over those not so treated, was 521 lbs., or 19 per cent.

Thos. D. West, of Sharpsville, Pa., in a written contribution to the discussion gave the results of his recent experiments on the question of expansion at the moment of solidification. He said that these had brought him to three conclusions:

"First, that hard grades of iron expand more than soft ones.

"Second, that large bodies have greater expansion than small ones.

"Third, that retarding or preventing free expansion by means of a rigid mold, whether by an iron chill or compact sand or brick, gives rise to a greater final contraction. In these last two statements it is understood that the comparison is made with iron from the same ladle pouring two different molds. The experiments made demonstrate forcibly the impracticability of thinking to define the percentage of silicon by the contraction of a test bar or casting, as it is claimed can be done.

"The first discovery is important in scientifically demonstrating why hard grades of iron shrink more, so as to require greater 'feeding,' than soft grades, a matter heretofore not satisfactorily understood. The fact here stated should prevent molders leaving their 'feeding heads' (as nearly all do) at the moment when their greatest attention and care are necessary to insure a solid interior to a casting. It is not while the metal is in a good liquid state that 'feeding' is necessary, but at the time when it is freezing or forming a solid crust. At these moments expansion takes place to stretch outward the forming solid crust, thereby causing a void which must be filled with additional molten metal to prevent the occurrence of shrink holes.

"The first discovery is also important in demonstrating that for chill rolls, car wheel work, etc., success is aided by utilizing expanding and contracting 'chills' wherever their use is practicable. The third discovery proves that if expansion can be prevented by means of a rigid mold, no shrinkage will take place to call for 'feeding,' but a greater contraction will be found in the casting than if free expansion had been permitted." Mr. West stated that his experiments led him to the belief that "expansion, the dividing line between shrinkage and contraction, is a quality (although unobservable in general founding) very effective in causing evil results, which with the cause understood and recognized, may very often be partly or wholly prevented."

Mr. Guy R. Johnson, of Embreeville, Tenn., made the point that deductions from phenomena observed in connection with a bar of certain dimensions, using iron of a certain chemical constituency, would not be a guide for work with castings of different size and made from iron of another grade. If low phosphorus pig iron is poured into a small test bar, the bar will show an enormous shrinkage. Make the bar of two-inch section and the shrinkage will disappear and the chill be very light. The speaker did not see how one standard size of test bar would produce results giving more than partial knowledge.

Mr. Wm. Kent, of New York, in referring to some of the data presented in the present discussion, particularly as related to expansion and contraction, said that the same ground had been traversed in the experiments of Messrs. Wrightson and Markham 15 years ago. Mr. Wrightson found an expansion of iron after being poured in a mold; Mr. Markham found no expansion. Mr. West suggested, in reply, that it was possible one of these investigators was experimenting with a harder grade of iron than the other used and that both were right. The question of grade, he contended, was an important one.

Mr. D. Townsend, of Wm. Wharton, Jr., & Co., Inc., Philadelphia, referred to the table submitted by Mr. West showing that high sulphur irons expand most at solidification. He had found, in the manufacture of chilled rolls that those falling below a certain percentage in sulphur crack, and that a certain amount of sulphur is necessary to a chill. His company, he said, used a round test bar of 1⅞" diameter. It bought all its iron on a guaranteed analysis accompanying each shipment and had a chemical and physical laboratory, following in cast iron as closely as possible the practice of steel makers. He expressed his gratification at the experiments and the paper of Mr. West and considered the data presented by the latter of great value.

Mr. Frank, of the Frank-Kneeland Machine Co., whose work, like that of the last speaker, includes chilled rolls, said that while he had not gone into the chemistry of cast iron so as to speak on that branch of the discussion, the theories as to physical phenomena which he had held heretofore had been upset by Mr. West's paper. In the chilled roll work of his firm they had been accustomed to attribute cracks to shrinkage. The theory had been that the outer chill acts on the casting as a hoop on a barrel. They and other heavy founders had been laboring to reduce shrinkage; but if the object to aim at is to reduce expansion, they had been operating in the wrong direction. Personally he wanted to express his obligation to Mr. West for the data presented.

Mr. E. D. Estrada, referring to the discussion on the same subject before the meeting of the American Society of Mechanical Engineers, said that he had then suggested that it was proper to consider whether iron did not expand rather than contract. He had come to the conclusion that there was an expansion at the moment of solidification, and by the use of the board the speaker indicated the experiment he had made to establish this fact, as outlined in an article by Mr. Estrada, in *The Iron Trade Review* some months since. By another diagram the speaker illustrated his own theory of the cause of three expansions as exhibited by the ½" test bars employed by Mr. Keep. His own investigations led him to the conclusion that there was but one expansion.

Mr. W. R. Webster, of Philadelphia, whose brief contribution to the discussion is given on another page, together with the drawings he presented, again called attention at this point to the fact that in all the recent experiments to which reference had been made in this discussion, conclusions as to contraction and expansion were drawn entirely from end measurements, which gave no information as to the volume of the casting, whether it had increased or decreased or remained the same. While on his feet Mr. Webster brought out an interesting and to many in the room, a novel effect, which he commended to the consideration of those who thought to judge iron by fracture. Covering a part of the broken end of a piece of gray iron with paper, he rubbed the uncovered portion of the end briskly with a stiff brush. The piece was then passed about the room. The portion that had been covered during the rubbing showed, as before, a gray iron; the portion rubbed with the brush had the appearance of a fair specimen of white iron. The explanation given by Mr. Webster, in response to the interrogative smiles of the audience, was simply that the rubbing had removed the loose-lying particles of graphitic carbon, so that the carbon left was practically all in the combined state. Further discussion of the question was participated in by Dr. Raymond, Dr. Leonard Waldo, of Bridgeport, Conn., Mr. J. F. Holloway, of New York, and Mr. West.

Business Session.

The latter portion of Thursday afternoon was devoted to the consideration of some changes in the rules of the Institute recommended by the Council. The result of the election of officers for the coming year was announced as follows:

President—E. G. Spilsbury, Trenton Iron Works, Trenton, N. J.; vice-presidents—H. S. Chamberlain, Chattanooga, Tenn.; Anton Eilers, Pueblo, Col.; Chas. Kirchhoff, New York; managers—James Gayley, Pittsburg; James F. Kemp, New York; Benj. S. Lyman, Philadelphia; secretary—Dr. R. W. Raymond, New York; treasurer—Theo. D. Rand, Philadelphia. The next meeting, it was announced, will be held in Denver.

The banquet of Thursday evening, attended by 250 members and guests, was highly successful. On Friday there were further excursions to various points about Pittsburg, the main party going to the McKee Bros.' Glass Works at Jeannette, the Latrobe Steel Works at Latrobe and the Pennsylvania Salt Co.'s Works at Natrona.

Personal.

F. J. Hearne, of the Riverside Iron Works, Wheeling, has gone on a trip to the Mediterranean.

S. T. Wellman is about to remove from Thurlow, Pa., to Cleveland and will be associated with his brother Chas. H. Wellman and with Engineer See, now of Pittsburg, in the Wellman Engineering Co. The new firm will have offices in the New England building on Euclid ave.

David Williams, of New York, has gone to the Bermudas for the later winter weeks.

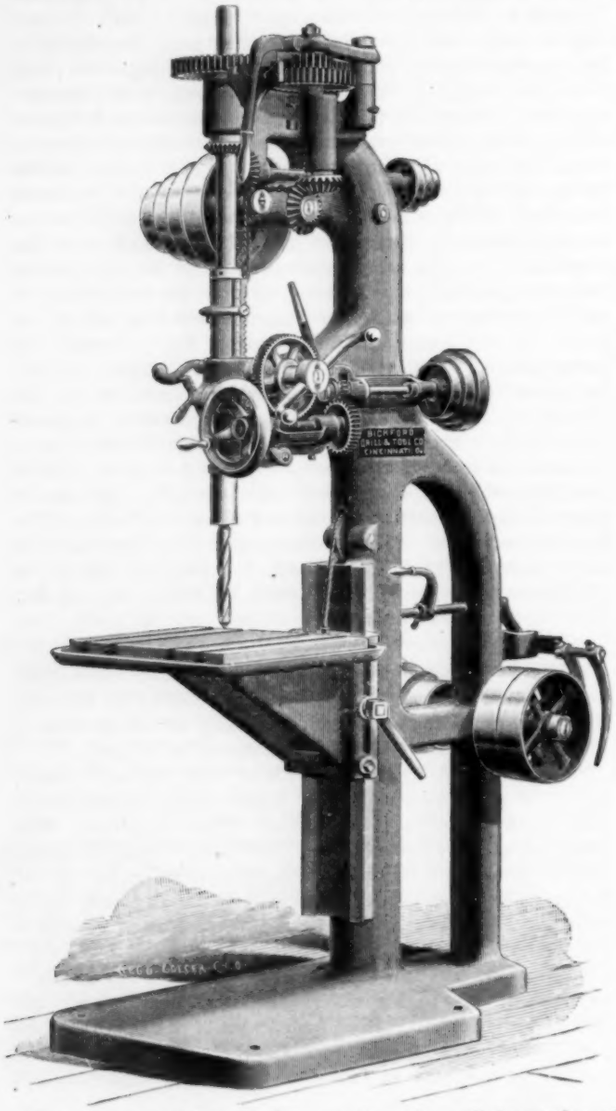
AT Reading, Pa., the Star Machine Screw Works and Joseph McConnell's nickel plating and bicycle works were destroyed by fire, Feb. 26.

NEW 24-INCH BICKFORD DRILL.

The cut shown on this page represents the maker's latest pattern of 24-inch drills. It is designed especially for rapid work on bicycles, and for the manufacture of machine parts where jigs are used for accurate work on irregularly placed holes for drilling and reaming.

The first essential feature is the arrangement of the countershaft and driving cone shafts, which are situated in such a way that a number of the drill presses can be placed in a row and parallel with the line shaft, avoiding complicated arrangements of extra countershafting and the use of belts. The drill presses can be set 30 inches apart, and still give the operator ample room for changing belts on the cones and shifting the countershaft pulleys. The jigs can be handled readily from the one table to the next.

Another feature is the arrangement of the back gearing. This can be thrown in instantly while the spindle is revolving. The rotation of the spindle can be stopped without shifting



the belt on the tight and loose pulleys by a slight motion of the same handle that throws in the back gearing.

The feed, which is both hand and power, also the quick return and approach motion, and the automatic stop are new. The drill can be instantly engaged and after the automatic stop device has done its duty the drill can be returned without loss of time, through unscrewing friction disks or other clutch arrangements. It is only necessary to turn back the double-ended ball handle, which is secured to the pinion or worm-wheel shaft. The automatic stopping is done by throwing the worm out of the worm-wheel, and the re-engagement is done by throwing it back into place. The worm on its swiveling shaft is always revolving, and therefore fits itself exactly in the teeth of the worm-wheel when approached by the conveniently placed hand lever. The spindle is counterbalanced and works on anti-friction ball bearings. The feed cones are placed on a horizontal shaft in the back of the housing, to prevent any oil or grease getting on their surface.

The tables are square, T-slotted, and provided with an oil channel. This is tapped for ¼-inch pipe to drain off the accumulated lubricating liquid for the drills. The table slides easily on shears, and is counterbalanced. It is set tight and rigid by means of one clamping bolt which presses the V-shaped jib firmly to the drill column, and which produces an exact alignment of the table surface. The ratio of the back gearing is 1 to 8½. The spindle gearing is large, and thereby gives the drill high efficiency. The table is 18x20 inches, which represents the planed surface. The adjustment of the table on the column, 16-inches; diameter of spindles at the quill, 1 9-16 inches. The spindle is bored to fit a No. 4 Morsa taper. The feed of spindle is 10 inches; size of cone pulleys, 10½-ins, 9-ins., 7½-ins. and 6-ins., for 2½-in. belt; size of tight and loose pulleys, 10 ins. for 3-in. belt. Speed of countershaft, 250 revolutions per minute. Weight of machine, 1,150 lbs. The makers are The Bickford Drill & Tool Co., Cincinnati.

PITTSBURG COAL IN SEMET-SOLVAY OVENS.

The paper of R. M. Atwater, read at the Columbus meeting or the Ohio Institute of Mining Engineers, and published in *The Iron Trade Review* of Jan. 30, gave in general the features of the Semet-Solvay system of coking coal, with recovery of by-products. Results were given, also, of tests made in Semet-Solvay ovens with Connellsville and Pocahontas coals, the coke having been used satisfactorily in the blast furnace. Much interest has been taken in tests of Pittsburg coal, some of which, conducted at Syracuse, have only recently been completed. The following report of a test of the Washington Coal & Coke Co's., Youghiogheny coal, was tabulated on Feb. 18, and some of the coke was exhibited to members of the American Institute of Mining Engineers at the Pittsburg meeting last week. Though the amount of coal used, 66 tons, was not sufficient for conclusive deductions, the coke made has been pronounced by experts well adapted to blast furnace work. The report below is signed by J. D. Pennock; the time of coking was 22 hours:

TRIAL IN SEMET-SOLVAY COKE OVENS OF COAL FROM WASHINGTON COAL & COKE CO.

Analysis of the Coal.

Moisture			.95
Volatile			34.20
Fixed carbon			57.15
Ash			7.70
Slack	Car No 135	Sulphur	1.076
Crushed	Car No. 142	Sulphur	.956
Run of mine	Car No. 123	Sulphur	.8019

Phosphorus .014 per cent. Nitrogen 1 48 per cent. Average sulphur .9446

Production of Coke.

	Coal.	Coke.	Per Ct.
Slack	31,900 lbs.	22,500 lbs.	70.5
Crushed	40,600 lbs.	28,800 lbs.	70.9
Run of mine	57,150 lbs.	41,000 lbs.	71.7

Considering the moisture in the coal and coke, we have:

Dry Coal.

Slack	31,900 lbs. at 5.50 per cent moisture	equals 30,145 lbs.
Crushed	40,600 lbs. at 5.85 per cent moisture	equals 38.225 lbs.
Run of mine	57,150 lbs. at 6.00 per cent moisture	equals 53,721 lbs.

Dry Coke.

Slack	22,500 lbs. at 3.50 per cent moisture	equals 21,712 lbs.
Crushed	28,800 lbs. at 2.75 per cent moisture	equals 28,008 lbs.
Run of mine	41,000 lbs. at 3.25 per cent moisture	equals 39,667 lbs.

SUMMARY.

	Coal.	Coke.	Per Ct.
Slack	30,145 lbs.	21,712 lbs.	72.02
Crushed	38,225 lbs.	28,008 lbs.	73.27
Run of mine	53,721 lbs.	39,667 lbs.	73.83

	Breeze.	Moisture.	Dry Breeze.	Per Ct.
Slack	1,240 lbs.	25.	930 lbs.	3.08
Crushed	900 lbs.	25.	675 lbs.	1.79
Run of mine	1,300 lbs.	25.	975 lbs.	1.81

Coke:

Volatile	3.60
Fixed carbon	85.75
Ash	10.65
Sulphur	.73
Phosphorus	.0194

By-Products:

Tar	80 pounds per 2,000 pounds coal.
Ammonia	18 pounds per 2,000 pounds coal.
Gas produced	9,360 cubic feet.

During the early part of the trial there was much back pressure on ovens and the gas got away with difficulty. During the latter part of the trial, however, there was not this difficulty. The gas was freed more readily and the coke was better. It resembled Connellsville coke in character.

THE LATEST IN "BABY BESSEMER" PRACTICE*

BY H. L. HOLLIS.

The paper of Geo. J. Snelus in 1894 before the Iron and Steel Institute, so fully and ably described the Walrand-Legenisel process, that there remains very little to add beyond recording some changes since then in practice, which the writer observed last summer at several continental works, and to state that this process has now been for some time in successful operation in this country.

The Walrand-Legenisel process is an addition to the Bessemer operation, with the object of obtaining quiet and more fluid steel and consequently sound castings and ingots. This is achieved by adding ferro-silicon at approximately the time of flame-drop in the ordinary Bessemer operation and making an afterblow. The rapid combustion of silicon immediately before pouring raises the temperature of the steel most noticeably and finishes the steel-making operation by the combustion of silicon to a solid (slag) instead of carbon to a gas. The high temperature thus obtained and the consequent fluidity of the steel are well shown by the very small and intricate castings, running down to a fraction of a pound in weight, which are regularly made. But perhaps the best indication of the heat of the steel is shown by the fact that as small charges as 600 pounds have been blown successfully for several years at Paris, and often the charge poured entirely into small work, taking from 15 to 25 minutes without a sign of skull in the ladles. At the Potter & Hollis Co's. plant at Chicago, heats of 1,000 to 1,200 pounds of steel have often been poured by means of two hand ladles of 100 pounds capacity (necessitating re-filling each five or six times) and not less than 20 minutes taken for the casting, and yet the ladles would be entirely free from skull at the end.

The investigation of the patent covering this process fails to show that anything similar has been done before, though in view of the calorific power of silicon and its well-known part in the Bessemer process, this may be considered surprising.

While details differ, the features common to the various works employing this process are these: The usual type of bottom-blown Bessemer converter is used. The pig iron is received in the ordinary way and the blowing is continued until about the time of the flame-drop, when the vessel is turned down and ferro-silicon (containing 10 to 12 per cent silicon) added. The after blow is then made, terminating at various times at various works. Ferro-manganese or spiegel is then added to the vessel for re-carbonizing and the steel poured into crane ladles or hand ladles.

Some differences of practices are noted: At the Legenisel works in Paris there are two converters—1,200 and 600 pounds capacity, respectively. The sprues and heads and all steel scrap are melted with the pig iron in the cupola and every cupola charge consists, after the first one or two heats, of about 80 per cent pig iron and 20 per cent steel scrap. The ferro-silicon and spiegel additions are melted in small cupolas and added from ladles. The converter is turned down the first time just short of flame-drop, to leave enough carbon to act as an index in the spectrum of the after-blow. The silicon in the steel varies from .02 to .05, seldom exceeding the latter figure.

At the Schneider works, Creuzot, one 1,500-pound converter is used. The steel scrap is added directly to the converter and the ferro-silicon and ferro-manganese are heated red but not molten. The vessel is turned down earlier in the after-blow and 20 per cent silicon in the steel is aimed at.

At Hagen, Westphalia, two 1,200-pound converters are used. The blowing is continued to flame-drop for the first turning down and time and general appearance of the flame rather than the spectroscope (as at the two works above) determine the length of the after-blow. The additions are melted in crucibles.

The practice at the Potter & Hollis Foundry Co's. works, Chicago, is this: A 1,500-pound converter is used. (Another is being added). The steel scrap is added entirely to the cupola mixture and the ferro-silicon and spiegel added molten. The most important change from Continental practice is in keeping the blast pressure below 10 pounds, while on the other side as high as 30 pounds per square inch is employed. Both the pin bottom, as used at Hagen, and the usual tuyere bottom have been tried, with no choice between the two as yet. Melting additions in crucibles is preferred to using small cupolas.

Entirely sound castings of any size, up to the capacity of the vessel, are obtained and the steel shows high physical tests. Carbon, manganese and silicon are entirely under control phosphorus and sulphur depend of course on the stock. Successive heats can be blown with practically identical composition.

At Chicago the composition for the usual run of castings is from 25 per cent to 30 per cent carbon, between 10 per cent and 20 per cent silicon, and about 60 per cent manganese Such steel gives, unannealed, 75,000 to 80,000 pounds tensile strength, with five per cent elongation in eight inches, and 70,000 to 75,000 pounds tensile strength, with 12 per cent elongation in eight inches, annealed. It is found, contrary to common experience, that the hotter the steel the more solid and more satisfactory are the castings.

Nothing is gained for castings, it is found, by running the silicon down for regular practice as low as .05 per cent. Increasing it even to 50 per cent greatly raises tensile strength without lowering elongation appreciably. It would seem that the very high casting temperature, with freedom from gas, produce physical conditions modifying the influence of chemical constituents.

A trial of this process with a large vessel (one of eight tons) at Les Acieries de France last summer gave a soft steel for wire, with chemical constituents of .02 per cent silicon .13 per cent carbon and .20 per cent manganese. The tensile strength was 50,000 pounds and elongation 27 per cent.

The merits of the process are: That it makes possible casting successfully in steel, small and intricate pieces; that it gives a steel foundry a fluid, quiet steel at intervals and in quantities desired; that the steel is so fluid and holds its temperature so well that it can be poured slowly over a lip and will not tear a green sand mold or carry in air, though for castings that must be machined for a perfect surface, however, dry sand is best; lastly, that the cost of installation is relatively small and the converter can be heated up in an hour ready for use. The process has demonstrated its value in making steel castings, and where increased solidity of ingots justifies the small additional cost, there may be a future for it in connection with large Bessemer plants. The same results are claimed by M. Walrand, with the basic process, substituting a high phosphorus iron for the ferro-silicon addition.

* Synopsis of a paper entitled "Notes on the Walrand Legenisel Process for Steel Castings" read at the Pittsburg meeting of the American Institute of Mining Engineers, Feb. 19, 1896.

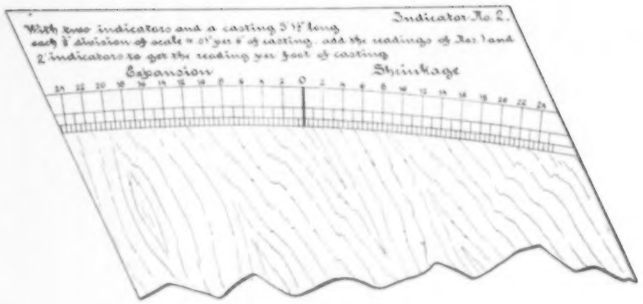
Chicago and Southern States Exposition.

Delegates from several of the Southern States met representative business men of Chicago in that city last week and made the preliminary arrangements for holding a Chicago and Southern States Exposition in Chicago during the coming fall. The objects of the Exposition are to set forth the resources and advantages of the South for agriculture, mining, forestry, and manufactures, and the establishment of such trade relations as would benefit both North and South.

A letter was read at the meeting from R. H. Edmonds, of Baltimore, expressing appreciation of the opportunity afforded by the holding of a Southern Exposition in Chicago, to draw the business interests of the South and the West into closer connection. He referred to the growth of industry in the South as indicated by a yearly output of pig iron, 10 years ago, of 500,000 tons against 2,500,000 tons a year; $30,000,000 invested in cotton mills 10 years ago, and to-day $110,000,000; 25,000 miles of railroad then, and 45,000 miles now; 10,000,000 tons of coal annually then and 30,000,000 tons a year to-day; $1,200,000,000 worth of agricultural and manufactured products a year then, against $2,000,000,000 worth a year now.

A committee from the Southern States, with Patrick Walsh as chairman, was appointed, with power to open headquarters in Atlanta and start a bureau of publicity and promotion. An address will be sent to the governors of the Southern States, over the signatures of a committee of Chicago men, asking for moral and financial support for the plan.

THE American Smokeless Furnace Co., of Cleveland, has recently equipped several steam plants with its furnaces. Among them are the Charity Hospital, on Perry st., the National Screw & Tack Co., and the Ursuline Convent, on Willson ave.



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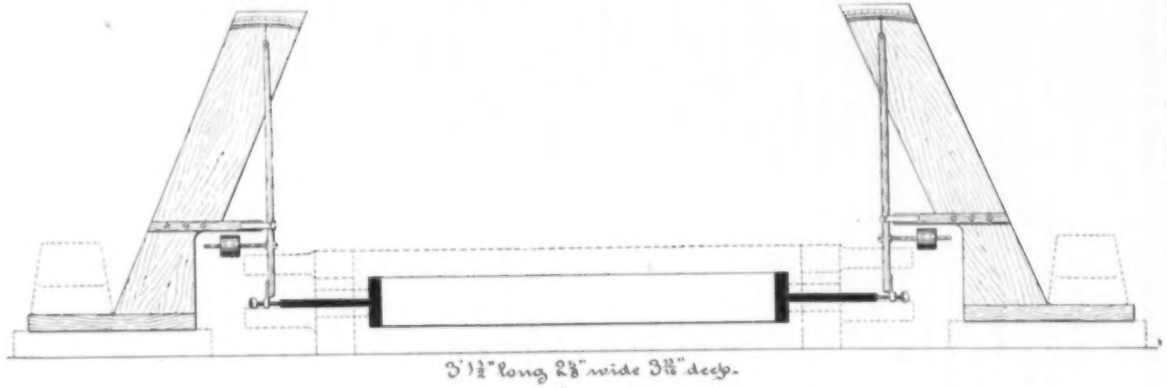


SECTIONAL ELEVATION OF TESTING APPARATUS.

JOHN R. WHITNEY'S EXPANSION AND SHRINKAGE TESTS OF CAST IRON.

EXPANSION AND SHRINKAGE OF CAST IRON.*

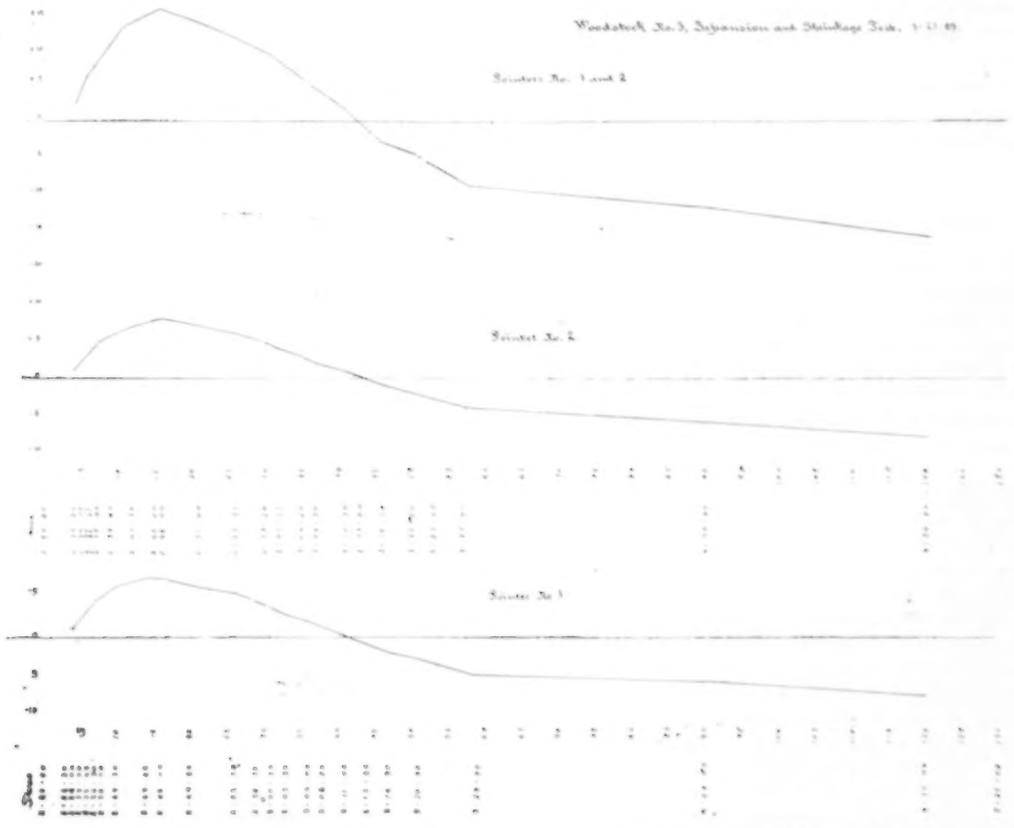
BY WM. R. WEBSTER.

In 1889, Mr. John R. Whitney, of Messrs. A. Whitney & Sons, Philadelphia, made a number of expansion and shrinkage tests upon molten and solidifying cast iron. He referred to this investigation in the discussion of an article entitled "Behavior of Iron in Solidifying" in the *National Car and Locomotive Builder*, May, 1889.

Messrs. A. Whitney & Sons have furnished me with the full records of this investigation and I have plotted the results of two of the tests in which all the conditions were the same, except the irons used. In the first case Hinkle No. 3 [Lake Superior charcoal] was used, and in the second, Woodstock No. 3 [Alabama charcoal.]

Bars 2⅝″ wide by 3 1/16″ deep and 3′ 1½″ long were cast in a closed flask. The cope was not removed in either case until the next morning, when the castings were too hot to handle with bare hands.

The drawings will show the apparatus used and general arrangements of pointers, etc. Pieces of electric light carbon were used at each end of the casting. When so arranged, each ⅛ inch division of the scale of each indicator represents



a motion of .01″ per 6″ of casting. To obtain the expansion or shrinkage per foot at any given time add the readings of the two indicators at that time together. The sign + indicates expansion and the sign — indicates shrinkage.

The electrical attachment and galvanometer were used in order to check contact of iron and carbon. This contact was not broken in any case.

The expansions are plotted above the horizontal lines on the accompanying drawings and the contraction below the horizontal lines. The figures given in the columns at the left side represent thirty-seconds of an inch on the scale of the indicator. The time of each observation is given on the horizontal line. This is given for each pointer; and on the top of the drawings for both added together.

In the case of the Hinkle iron, you will notice two expansions; while in the Woodstock iron there is only one expansion. In all the 17 tests made, the Hinkle iron was the only one that showed this second expansion. All the others showed the first expansion similar to the Woodstock iron.

Mr. Whitney's attention was called to experiments of Mr. Wrightson and to those of Mr. Charles Markham, given in their papers before the Iron and Steel Institute in 1879, 1880 and 1881. He stopped his investigation on finding that so much had been done by others, and that it was necessary to measure the width and thickness, before any reliable results rould be obtained. I call particular attention to this in view of the recent investigations in this same line of work.

Mr. Markham stated that Sir Lowthian Bell, in his experiments (in 6″ cylinders 72 inches long) found that cast iron expanded for an hour; whereas he (Mr. Markham) showed in his experiments (in 4″ cylinders 9′ 4″ long and rectangular pieces 4″x5″ by 30 feet long) that no expansion took place after the iron was run.

Mr. Wrightson called attention to the important fact that Mr. Markham had not taken any measurements of width and thickness and therefore could not show any *increase or decrease in volume.*

As this matter now stands, we need more light on it before drawing any general conclusions from a few observations.

*Contributed to the discussion on "The Physics of Cast Iron" at the Pittsburg meeting of the American Institute of Mining Engineers, Feb. 20, 1896.

CONNELLSVILLE coke production has been falling off steadily. In the week ending Feb. 15, the estimated total was 122,215 tons, active ovens being 12,480, a decrease of 229 from the week previous. The *Courier* says: "The coke makers do not feel absolutely sure that they can keep the price of coke at $2 per ton after the first quarter. Some consumers hint that another circular will follow on March 1st announcing a reduction to take effect April 1st. Much of the truth in their argument depends on the improvement in iron circles. If pig iron advances a dollar or so before April with a brisk demand for it, there will be no reduction in coke. If it doesn't, a different story may be told."

According to the latest advices in our possession, there are now 34 black plate plants in operation or ready to operate, with 163 black plate mills completed. Most of these plants have the equipment to coat some or all of their black plate; four of them have additional black plate mills to the number of 14 in process of erection, while there are three black plate plants with eight mills in process of construction. This makes a total of 37 black plate plants with 185 mills, built or building. Of the black plate mills ready to operate, between 75 and 80 per cent are turning out their full quota of black plate. There are about 34 coating plants, and between 50 and 75 per cent of them are in steady operation.—[Tin and Terne.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday evening, February 19, 1896, at the Great Northern Hotel, Chicago. Mr. A. W. McArthur occupied the chair in the absence of the president. The following were present: A. W. McArthur, Rockford Foundry Co., Rockford, Ill.; John Pettigrew, Illinois Steel Co., Joliet, Ill.; F. M. Lyon, Burlington Route Foundry, Aurora, Ill.; Mr. Harry, Gibson City Iron Works, Gibson, Ill.; J. H. Dalton, Walburn-Swenson Co., Chicago Heights, Ill.; H. D. Johnson, H. L. Greene, Studebaker Bros., Mfg. Co., South Bend, Ind.; E. E. Hanna, Wm. Ferguson, Gates Iron Works; Robert Gibb, D. H. Truesdale, Cribben, Sexton & Co.; H. F. Frohman, S. Obermayer Co.; E. W. Smith, D. De La Fontaine, The Crane Co.; Ed. Welch, Weir & Craig Mfg. Co.; A. Sorge, Jr., M. E.; H. L. Hotchkiss, J. L. Hecht, Deering Harvester Co.; C. O. Billow, National Supply Co.; C. E. Louis, Rogers, Brown & Co.; O. T. Stantial, Illinois Malleable Iron Co.; A. J. Oehring, B. S. Summers, Western Electric Co.; S. T. Johnston, Whiting Fdy. Equipment Co.—of all Chicago.

The secretary read the following paper by Mr. H. Hansen, of St. Louis, on

"Oil as a Fuel for Core Ovens:"

Coremaking goes back further than any of us can remember, and that is as far as we need go to look for its antiquity, for a great deal of this antiquity is still with us, hanging on with the friendly hold of time honored custom, and in no hurry to say its last good-bye.

The persons selected for coremakers have in the past (and some of you are not above suspicion in this respect to-day) mainly been chosen for their ability to withstand abuse. In the forenoon they are called down for making away with the molders' gaggers, and in the afternoon the blacksmith is liable to entertain them for purloining some rods intended for a nobler purpose, while at night time, when anything has happened to a molder's work, you know how ready he is to unload the blame upon this same much-despised, much-abused coremaker.

But coremaking is making progress, like almost everything else, because it must. It is compelled to by the demands made upon it for better work, and more of it. The successful foundryman to-day gives the core room its share of attention as well as the foundry. He not only wants a core that will hang together but also shake out easy. He is opposed to using more rods than is absolutely necessary, not only because it is unpleasant to hear some imported foreigner taking them out, it is also expensive, and has led many to alter their mode of coremaking so that it allows these to be made and used without containing a single rod of any description.

One thing calls for another, however, and the core sand mixture that allows cores to be made from it of almost any dimensions without rods or anything else to support it also calls for great care in baking it, while many core ovens are heated in such a manner that the cores will not even dry thoroughly, not to speak of baking evenly.

There is a vast difference between drying and baking a core, and with improved sand mixtures it becomes an absolute necessity that a core shall be baked. This may seem easy enough to accomplish, and would be if we only had to occupy a small part of an oven, but with this filled with cores, it becomes a most difficult matter to secure an even temperature throughout that will permit of all cores being baked evenly. Any kind of fuel will dry a core, anybody can do that, but when it comes to baking the same there is a chance to do some good hard thinking.

What is needed to bake a core is a certain amount of heat. I say certain, because too little will dry them without baking, and too much will burn them, causing trouble again. Most kinds of fuel give off a strong flame, and then we find all kinds of cores in an oven when the doors are opened. The hottest part of the oven furnishes some burnt cores; the coolest part some thoroughly green ones. Next to these come the cores that are dried but not baked, and lastly a small lot between those that are dried and those that are burned, which are found to be just right. Sometimes a whole oven-full is burned; again, they may be all green. But it is very seldom, with ordinary ovens and fuel, that we find the whole number just done brown. We find the element of uncertainty coupled right on to the core oven, and in most places, when the fire is started, no one knows what kind of cores are going to come forth.

What else can be expected from a fire made with fuel that is uncontrollable? On clear and cold days the draft is good, and the first thing you know the cores are burned. The next day it is warm and raining, and you wonder how it came about that things are not right. If you are burning the ordinary fuel, such as coal, coke and wood, and you think anything about what you are doing, you soon begin to consult the Rev. Hicks's almanac to find out how to fire up.

A fireman will keep his steam at a certain pressure throughout the day. He will produce a certain amount of heat underneath his boiler. He can do so because he has got something to go by, the steam gauge. He does not guess at what he is doing, as the coremaker does. How would it do to put a heat-recording instrument on the core oven? Some of you may be inclined to take this as a joke for your jollification, but it is not intended as such, although you would make a jolly person out of the coremaker if you would carry it out.

If experience will demonstrate that a core oven will bake cores of a certain kind, made from certain materials, with a known amount of heat in a given length of time, why would it not be possible to so arrange things that this could be done time and time again? If 400 degrees of heat will bake a core in two hours, why not put some recording gauge on the oven that will allow this to be ascertained? As it is now, we have, may be, 300 degrees for five hours, and still the cores are not baked, only dried. Then, again, we may have 500 degrees for one hour, and burn them. Could anything be more uncertain?

When you want to measure a length, you apply a rule. When you desire the weight of any body, you furnish a scale. When your perspiration reaches an unbearable point, you consult a thermometer. But when you want to know the amount of heat in your core oven, what do you do? You wink your eye, and say: "Well, they ought to be done, anyhow." When you later on become aware of your mistake in pronouncing this opinion off-hand, you finish up with a disgusted look, and the remark that they looked like it, at all events. If a certain amount of heat will bake a certain class of cores in a certain length of time on one occasion, the same can be accomplished at any other time, under like conditions. Is this not a logical conclusion? For the sake of obtaining better results and for the quick handling of core ovens, give us something to guide us through our uncertainty in this respect.

Bread baking is a great deal like core baking. Things want to be just right in both cases. Many of you have seen scorched bread, not because the housewife was talking to the neighbors, but because she had no other alternative but to guess at the condition of the oven. I once visited the Soldiers' Home, at Quincy, Ill., and was shown through the bakery, with loaves stacked up like cordwood, all looking exactly alike, just the color when bread looks appetizing. Prowling further around, I soon found the cause for this beautiful condition of affairs in a thermometer attached to the oven. The man in charge said: "We maintain a fixed heat for so long, and we can't miss it, if we wanted to." I asked myself, right there and then, Why can we not do the same way with our core ovens? Make them so hot for so long and be done with it, and be done right, too. It is well enough to guess at a thing, if we can guess very close to exactness, but most of us make poor hands at this when it is applied to such a business as running a core oven.

As said before, what is wanted to bake cores is heat, not flame. Fuels that make a great deal of this are most unsuitable, if the fire is placed right in the oven. Wood, giving off the most flame, is the poorest fuel. Soft coal is nearly as objectionable, and coke, to a certain extent, so. A coke fire will yield an intense heat for a short period, and although it does not give off a great deal of flame, yet any fuel that is fluctuating in its heat giving qualities should be considered as undesirable for a core oven, without some way of regulating it.

When a core oven assumes any proportions to speak of, it becomes a serious matter to heat it uniformly enough to insure the baking of all cores placed therein, without burning

any of them. Several small fires in one oven will produce better cores than one large fire will, but the trick lies in keeping these going. Right here, fuel oil offers one of its special inducements, in that not only can it be burned in one place, making a large fire, but it can as readily be scattered into a dozen smaller ones, thus from the start aiding in the diffusion of heat, a quality that but few other fuels have. With a fire that could instantly be increased or lowered in intensity, what a pleasure it would be to work around a core room.

The means for accomplishing this lies within the power of any progressive foundryman, and is found in crude oil, or, as it is generally designated, fuel oil, from the fact that it is used only in that capacity, being unsuitable for illuminating. With a fuel as easily regulated as the light of a lamp, as clean as gas, and not so high in price as to prevent its use on a commercial scale, what is to hinder it from becoming universally applied to core ovens?

I know in some foundries coremaking don't amount to much, and as long as you can get a core that will hold to handle, you say, "Good enough." With shops where coremaking costs 30 per cent, or more, of the labor account, this item is looked upon from a different point of view. You have often felt how annoying it was to find some small cores out of stock when wind time was at hand. How do you think you would feel with an oven full of burnt cores on your hands, the molders clamoring for cores, the general expenses of the shop keeping right on, and somebody waiting for the castings at the same time?

Scratching your head won't bring a lot of burnt cores back to life any more than it will stop a runout. And you will have reason to scratch, if you try to make cores on a paying basis and attempt to bake them with ordinary fuel. Maybe, you can get fairly good results when tending to the oven personally, but the first thing you know, something calls you away, and when you return, the individual whom you told to keep an eye on it is trying his best to keep out of your sight, for reasons that you soon come across.

In baking cores with ordinary fuel, a great deal of it is wasted. There must be a draft, or else the fire will not burn; and the amount of heat that passes through the smokestack amounts to something in a year. Coal, theoretically, contains about 14,300 heat units, and nearly 7,000 of these are lost in gases that escape through the stack (and from other causes). There are practically only about 8,000 heat units available in coal that can be utilized in the generation of heat. One pound of crude oil has, according to late experiments, 20,240 heat units. In comparing the calorific properties of crude oil, it must be borne in mind that with coal there is an enormous waste of matter, while, on the other hand, every unit of heat that the oil contains is utilized, as there is no soot, smoke or odor, and a clear fire is generated, similar to that of natural gas. This is especially desirable in the baking of cores, as with a properly constructed furnace, within three minutes after starting the oil fires, the draft can be closed entirely, and after the burners have burned for about one-half hour, the oven will contain enough heat to bake all the cores that it contains, so that one-half hour's work with oil will accomplish the result of from four to five hours of coal, coke or wood.

An oil fire, by the latest developed system, is absolutely smokeless and odorless, and can be regulated to any degree of heat desired. As no furnace door is provided and as it is not required to feed the fire, as with coal, coke or wood, no cold air rushes in, which is a detriment to the cores as well as to the furnace. Cores will be more conveniently and quickly baked with oil than with any other fuel, and, besides, the fires require very little attention.

With common fuel we must use more than is actually consumed; with oil, we cease to use it the instant the cores are baked sufficiently, and don't have to wait either for a large fire to burn itself out before the cores can be removed. Where an oven is used continuously, the saving of time in starting and closing a fire will be appreciated about as much as the economy in the fuel itself.

Neither will common fuel come right into the oven by simply turning a valve or two. You must have somebody to poke the cinders out, someone to wheel in coal or coke, take out ashes, cut up kindling wood, and even if you do live in a country where coal is cheap, it costs you a good deal more than you think for, by the time you get all out of it you can and get the rest wheeled away.

Two systems are in use for the utilization of oil as a fuel, one of which is operated by compressed air, and the other by gravity and steam. In the latter system, the oil is stored in a tank outside the building, and an oil pump takes the oil from the tank and forces it into a stand-pipe, from where it is carried by gravity to the burners. In order to keep the stand-pipe full and maintain a uniform gravity pressure, an overflow returning to the storage tank is attached. The burners are connected with steam pipes, the flow of steam atomizing the oil, intermingling it with a supply of hot air kept up by pipes from the furnace. The whole passes from the burner in a highly combustible and vaporous form, causing perfect combustion.

The other system substitutes for the oil pump and stand-pipe an air compressor, by which the oil is forced from the storage tank to the burners, there meeting a supply of air from the compressor. Both air and oil, as also steam and oil, are regulated by suitable valves. Of the two systems, the one operated by steam will doubtless appeal most strongly to foundrymen, for its simplicity and ease and certainty in operation.

With crude oil delivered in carload lots at Indianapolis for 1⅞ cents per gallon, in St. Louis for 2 3-10 cents, Cleveland 1 7-10, and in Chicago for 1⅞ cents, there is not much to say in regard to high prices. And when it is remembered that with the best systems from 70 to 100 gallons of oil equal one ton of the best coal, and the cost of handling same is considered it is plain that it can not be long before this elegant fuel will do its own talking.

There may come a better way of heating a core oven, but until we find it in the shape of electricity, or something else, crude oil is worth considering, for it will cure and remove permanently the scowls and uncomplimentary tributes now paid to the coremaker. The kind of fuel we require for core ovens is not one calling for six months' training on the part of the one who attempts to handle it. What we do need is a kind of fuel that twenty words of plain English will enable the uninitiated to take a firm hold of, without being bucked off. And such we have in crude oil, the ideal.

Discussion.

Mr. Billow: The paper is good as far as it goes, but it does not give us many data to work upon. The writer says fuel oil is a good thing, and I can agree with him on that point. To what extent it is a good thing depends upon the natural conditions very largely. There are places where fuel oil could be used to greater advantage than coal. This depends upon the price of the two commodities where used. The writer calls this crude oil or fuel oil. Crude oil and fuel oil are not the same. Crude oil is oil as it comes from the wells. Fuel oil is a residuum or by-product from the distillation of crude oil and cannot be used for any other purpose than fuel. The manner in which the writer describes the leading system for using oil to-day, shows that he is describing a system that was used with crude oil as a fuel. Early in the discovery of oil it was a great problem how it could be refined. At that time the price ranged from 15 to 20 cents per barrel of 42 gallons. To-day the oil is worth 90 cents a barrel at the well. The system described by the writer of the paper was one that was used with crude oil. We find that at present we have to use an oil which must be heated to 100°, and which being very heavy at low temperature will hardly run at 40°. It must be heated to 90° or 100° before it can be used at all. To produce the same results that were produced by the crude oil we must bring this oil as near the crude state as possible and this can only be accomplished by feeding the oil under a high pressure and a uniform flow. The fuel oil has a theoretical value of the amount the gentleman mentions or a little more. It has theoretically 40 per cent more heat than coke, while in actual practice it has double the amount, because coke cannot be evenly fired. He gives us no data in regard to core ovens. As I understand a core oven it is to-day the same as has always been used. It is usually a large square room. The heat should not be used directly, but indirectly. A core-oven should be built like a baker's oven. I cannot agree with the gentleman that it is necessary to stop down the dampers to use the oil. It is very essential to have a circulation.

I should like to speak of the manner of atomizing the oil by steam. Steam is usually made by a boiler a long way from the core oven. When it reaches the oil-barner it takes from 10 per cent to 12 per cent of the dry steam to atomize the given amount of oil. A large percentage can be added to this for condensation. A better way, if oil is used in firing a core oven, is to use a positive blast blower working under a low pressure, from eight ounces to two pounds. This is more economical than steam in the manufacture of terra cotta and brick which require a greater heat, the process being the same as core-baking, but carried much further.

Mr. Sorge: The greatest difficulty with core ovens, as Mr. Billow remarked, is in the construction of the oven itself, more than in the different kinds of fuel. The oven spoken of in the paper is a square box, in one corner of which is a fire and at the top, in the diagonal corner, is a hole. A fire is built and an attempt made to dry cores with the usual result of irregular work. As far as fuel oil for the core oven is concerned, we do not know in advance what the price of that fuel oil is going to be. It is apt to be 1⅝ cents one week and the next week three cents. The great difficulty with the price of fuel oil is that it is controlled by people who work it for their own advantage and we have no security from week to week whether we are going to get the oil at a price that is profitable to us or not. After we have put in an apparatus it is rather expensive to tear it out and put in another for coal or coke. I agree that the construction of the core oven is the main point, no matter what the fuel is. If your fuel is properly burned, the products of combustion from fuel oil and those from coal or coke will be almost identical, and, therefore, the effect upon the cores will be identical. In my experience the fuel cost of oil was about 40% greater than that of coal.

Mr. Billow: Mr. Sorge raised the question of the price of fuel oil. I want to state again that fuel oil as used to-day, is the by-product from the distillation of oil. It cannot be used for any other purpose than fuel. Coal is the arbiter of fuel values. A river cannot rise above its source. This oil must be used for fuel or it must be dumped on the prairies or into the lakes and rivers. Fuel oil is just as valuable as coal will permit it to be and no more valuable. So long as the methods and application of fuel oil advance, so long will the price advance, as the Standard Oil Co. has never been known for its philanthropy and is going to obtain the highest market price for its product. There are about 18,000 or 20,000 barrels of fuel oil produced in the United States every day. There are about 500,000,000 tons of coal burned in the world every year. If all the oil produced were made into fuel and used for fuel, exclusive of any other use, it would not amount to three per cent of the amount of energy produced by heat, and therefore the use of fuel oil could hardly regulate the price of a commodity as a heat producing agent.

Mr. Sorge: It has been my experience to have the price of fuel oil raised from 1⅝ cents to three cents in two weeks.

Mr. Ferguson: I had about two years' experience in using fuel oil, both in the core oven and in drying molds and had a good deal to do with the construction of the ovens that were put up for that purpose. Knowing that it was an experiment with us, we built the ovens as though we were going to use coke and built the fire-place to use coke. The thing, as far as I knew, had never been tried before. As far as the utility of it was concerned, it was very satisfactory. It was handy in many ways. The fire was readily started and readily extinguished. The question of price was brought up many times, but it was dropped and I never knew anything about it.

Mr. McArthur: About what was the cost of rigging up the oven?

Mr. Ferguson: It was simply the matter of running two lines of pipe, one from the oil and one from the steam. We used both steam and compressed air. Compressed air with us was more satisfactory.

Mr. McArthur: Could anyone give a close approximation of the cost of rigging up an apparatus for burning fuel oil, provided the foundry would have to put in a new compressed-air plant?

Mr. Billow: I could give an approximate idea, provided I knew how it was wanted. You could stand off with a shovel and push oil into a furnace and it would burn. Oil from a stand-pipe with a steam burner under actual experiments made by me was 16.58% more expensive than oil atomized by air pressure, counting 6% of that for maintenance of the air-compressor. Where they were using the stand-pipe system with steam burners and and long lines of steam pipes, the system was changed to the one I spoke of as being the most economical, namely, oil atomized by air by means of the positive blast blower, high-pressure and high temperature apparatus. The latter apparatus exceeded the efficiency of the former by 30%, 12% of which was due, as was demonstrated, to putting on the high-pressure apparatus, the balance, 18% being due entirely to using air under a low blast instead of steam. I would name $1,000 as the approximate cost of rigging up an apparatus.

Mr. Pettigrew: The only experience I have ever had with fuel-oil was that we used it for several months in melting iron for cast rolls. We found it diminished the amount of labor and the price was the same as we were paying for coal. Coal cost us in the vicinity of $6 per ton, and the oil, I guess, was about 1½ cents to 1⅞ cents. The greatest trouble we found was the oxidation of the iron. I never had anything to do with the drying of cores by oil. I will say that in melting iron we could never raise the heat high enough with oil to pour two rolls out of the same ladle. We had to stop up the furnace between the two taps; in using coal we did not. The greatest fault I find with oil is the oxidation of the iron. The large amount of oxygen carried along with the oil burns up the silicon first and then takes the carbon. When coal is used with a good heavy bed it makes a reducing flame. I have seen the result of drying cores in Pittsburg with the use of natural gas and it was very satisfactory. They use a very heavy bed of small coke to pass the gas through. That is to get a uniform heat.

Mr. Oehring: I have never had any experience in connection with the use of oil as a fuel; but it seems to me that the question of the construction of the oven is of more importance than the question of the fuel. As a rule the ovens are all made of one size. They generally make one oven, which is used for the large work and the small work as well. They fire it up and put the work right in and take the chances on the outcome of it. It seems to me that perhaps two sizes of ovens, one for small and one for large work, and with shelves separated, would be better.

Mr. McArthur: It seems to me that the question has resolved itself into this: The matter of price is a question of heat units and the only question is if the heat from oil is as satisfactory, or more satisfactory, than the heat from coal or coke? I can see no reason why, with a suitably constructed oven you cannot get as good results from coal or coke as from fuel oil.

Mr. Johnston: I should like to describe a core oven I saw a little while ago at Columbus, O. I have heard foundrymen speak of the foundry as a model foundry, and I think the core oven a model oven. The core oven was about the shape of a table, being a little longer than broad. The fuel was coke. The fire was up about four feet over the floor level and around the floor were draft flues, placed about two feet apart. The foundryman ran his cores in on a car, and when he put a long core in the back he opened the two flues below it and the heat naturally went that way. He could draw the heat which ever way he wanted. The flues were connected with the stack outside. He claimed he had good results.

Mr. Pettigrew: The best oven I ever saw was down in Homestead. They had a great many cores to dry and they had to do it all at night. The cores had to be made, as a rule, during the day and run into the oven to dry at night. The question of the distribution of heat is the main thing after all. If you do not have a core oven properly built you will never get the proper heat whether you introduce the heat by one flame or a half dozen flames. You have to have a regular connection with the chimney. The best oven that I ever saw was about 11 feet high. It was fired all along one end with coke as a fuel, with the bed well built up, say within two feet of the top and a wall between the fireplace and regular oven. The flues were regulated along the middle and sides. The night watchman could regulate the oven while he was attending to his other duties. If he had small cores in one corner these flues could be shut off, and if he had large ones in the other corner, the other flues could be kept open. The circulation of the hot air would thoroughly dry the larger ones, while the other cores were kept in proper shape.

The meeting then adjourned.

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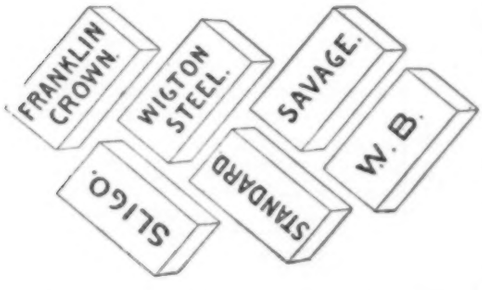

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Crown Point (Ind.) Mfg. Co., will enlarge its foundry considerably. An electric light plant is also to be installed.

The Donaldsonville (La.) Foundry & Machine Works have increased capital stock from $6,000 to $10,000 an enlarged, etc.

The Skandia Mfg. Co., has been incorporated at Rockford, Ill., to manufacture agricultural implements, with a capital stock of $20,000, by C. J. Anderson, C. J. Valentine, and C. A. Lind.

The Holson Mfg. Co. has been incorporated at Chicago with a capital stock of $10,000, to manufacture machinery, by Albert B. Holson, Edward A. Steubeck, George T. Olson and Martin V. Olson.

Willis Shaw, 416 New York Life Bldg., Chicago, wants to buy a large size rock crusher, a concrete mixer, and an air compressor suitable for supplying three rock drills. All to be in good condition.

The Indiana Road Machine Co., of Fort Wayne, Ind., has been incorporated with a capital of $60,000. The directors are J. C. Peters, M. Hamilton, A. E. Hoffman, E. H. McDonald, Daniel Tegtmeyer, D. N. Foster, Perry A. Randall. The company will erect extensive shops at once.

The Clement Pneumatic Tool Co. has been formed at Philadelphia, to conduct the manufacture of the Clement pneumatic appliances for caulking, clipping, die-sinking, etc. The officers are Thos. Leatheryard, president; M. M. Coppuck, secretary and treasurer; H. S. Robbins, general manager.

Additions, Enlargements, Removals, Etc.:—

The Morton Tin Plate Co., Cambridge, is adding to its plant an additional tinning set for the manufacture of heavily coated terne plates.

The plant of the Irondale Iron & Steel Co., of Middletown, Ind., will be enlarged and the capacity greatly increased in the next few months.

Fires and Accidents:—

The foundry and machine shops of the Whitman & Barnes Mfg. Co., West Pullman, Ill., sustained a loss of $25,000 by fire,

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1—36x36x20 ft. N. Y. Steam Engine Co. Planer.
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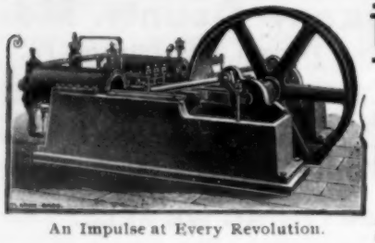

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caused by an overheated furnace. The burned part will be re-built at once.

The machine shop of the Carterville Foundry & Machine Co., Carterville, Mo., was burned on the 9th inst., with a loss of $7,000, on which the insurance was $1,000.

New Construction:—

It is reported that a new bicycle plant employing 150 hands will be located at Anderson, Ind., by a syndicate represented by J. B. Lott.

The Sebastian Lathe Co., Cincinnati, has broken ground at Covington, Ky., upon which a brick building, 75x90 feet, especially adapted for the production of lathes will be erected.

McRae & Roberts, of Detroit, are building a new brass foundry that will be four times as large as their present plant. The main building is 310x90 feet, three stories and basement.

The Missouri, Kansas & Texas will probably establish new shops at Sedalia, Mo., for locomotive repairs. It is expected to have these shops in operation by April 1, and they will give employment to about 100 men.

The Putnam (Conn.) Fonndry & Machine Co. will re-build its foundry and machine shop on the site of the old buildings. The machine shop will be 40x90 feet, two stories high, and the foundry and engine building 56x160 feet, one story high.

The Whiting Foundry Equipment Co, Chicago, has begun erecting a new office building for its Harvey plant, to replace the one recently destroyed by fire. The new building will be 32x75 feet in size, one story high, and built of brick with all modern improvements. The space formerly occupied by the office will be added to the erection shop.

The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract for furnishing the iron work for Meara Bros., new block at Torrington, Conn. It is three stories high and the girders are placed in the ceiling of the first floor and made sufficiently strong to support the two upper floors. The top floor is a dancing hall and the structure has been made with the view of making the building as stable as possible, and avoid any danger of vibration caused from the use of the hall on the upper floor.

General Industrial Notes:—

The Pittsburg Tin Plate Works, New Kensington, Pa., are to put a third mill in operation next month.

The Atlantic Iron & Steel Co., of New Castle, Pa., has its north stack fitted up and has just put it in blast.

R. Hoe & Co., New York City, have added two Whiting

cupolas to their foundry, largely increasing their capacity in this department.

The Northwestern Iron Co., Mayville, Wis., is making improvements in its furnace increasing its capacity 30 per cent. It will be completed by April 1.

Nos. 3 and 4 blast furnaces of the Pennsylvania Steel Co., Steelton, Pa., have blown out for an indefinite period. No. 1 is on speigel and No. 2 on Bessemer.

The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract for a steel floor to be placed in one of the buildings of the Alexander Smith & Sons' carpet factory at Yonkers, N. Y.

A new engine house, 25x38 feet, will be built by the Andrews & Hitchcock Iron Co., of Youngstown, at its blast furnaces. Orders have also been placed with Wm. Tod & Co., for two new engines.

Skinner Chuck Co., New Britain, Conn., and 94 Reade street, New York, has added to its variety of lathe and drill chucks. This has necessitated the installation of new machinery and special tools and an increase in the number of workmen.

Howard Morris, of Milwaukee, receiver of the Wisconsin Central Railroad, has been appointed receiver of the West Superior Iron & Steel Co., to succeed Robert Kelley, who resigned to become general manager of the Punxsutawney Iron & Steel Co., of Pennsylvania.

As the spring season of painting and re-painting comes along there is sure to be offered something new in the way of paint mixture for the protection of roofs, iron work, etc. Mention may properly be made in this connection, of Dixon's silica graphite paint, which has been favorably known for over a quarter of a century. Railway and other corporations that thoroughly test and carefully select materials, use this paint in large quantities. It is the product of the Joseph Dixon Crucible Co., Jersey City, N. J.

The Lorain (O.) Foundry Co. has organized by electing M. M. Suppes, president; F. A. Smythe, vice-president; William F. Saltmarsh, secretary and treasurer. The directors are: M. M. Suppes, W. A. Donaldson, J. K. Frye, William Masterson and F. A. Smythe.

The S. R Smythe Co., of Pittsburg, has just closed a contract for a complete open hearth steel plant for Jones & Laughlins, Ltd. The plant will have a capacity of 12,000 gross tons of steel per month, and will have all the latest devices and machinery for labor saving and cheap production.

Negotiations are being made by the Bath Iron Works for utilizing electricity instead of steam. The works will require about 16 motors, varying in capacity from three to 40 horsepower. The objects of this change are the saving of labor and power as well as expense. The work of making the change will take from 60 to 90 days.

The Anniston Pipe & Foundry Co., Anniston, Ala., has purchased the Anniston Pipe Works, which it has been operating under a lease for three years. Improvements will be made at once; a fifth pit, which has been heretofore unused, will be started, and the sixth pit will be equipped and started on molding 60-inch pipe. The company also thinks of putting in electric power.

The basic open hearth steel plant at Ft. Payne, Ala., is being run on an experimental test of 30 days. J. K. Lanning, under whose supervision the mill was built, and E. Robinson, formerly of the Otis Steel Works, Cleveland, is the melter and

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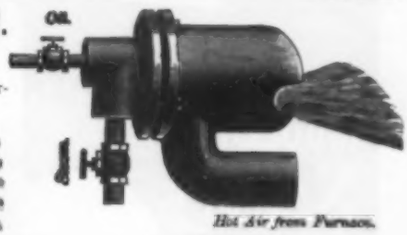


BURNER NO. 4

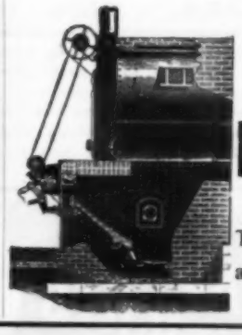
BRANCHES. { 1511 Monadnock Block, Chicago. 21 and 23 Fremont st., San Francisco.

NOTE.—If you are using oil as fuel, and are not getting good results, we would be pleased to send you our burners on trial. The oil in our burners can be atomized by either steam or air.

Bolt and Nut Works.

THE UPSON NUT CO., Manufacturers of Nuts Washers, Carriage, Machine, Plow, and Elevator Bolts, Coach Screws, etc.

N. W. TAYLOR. H. H. CAMPBELL.



Brightman Furnace Co.

648 Broadway, CLEVELAND, O.

SOLE MANUFACTURERS OF THE

Brightman Mechanical Stoker

FOR STEAM BOILERS.

THE MOST ECONOMICAL IN FUEL

and the Best Device in the World for Preventing Smoke.

Send for Catalogue "A."

THE FINISHED STEEL CO

YOUNGSTOWN, OHIO

MFR'S OF **POLISHED SHAFTING**

chemist. The product will all be sold as ingot steel, and no effort made to run the blooming or billet trains until the possibility of making a good steel at a profit is demonstrated.

Of the improvements to be made at the plant of the Ironton Structural Steel Co., at Duluth, Manager J. E. York says that the total cost will be nearly $200,000. The new blooming mill with an immense hydraulic shear, only second in size to one in the largest Pittsburg plant, the soaking pits, the basic open-hearth furnace and the electrical crane and charging service are all either placed or are now being negotiated for. The expectation is that when the work is completed the capacity of the plant will be 200 tons daily of finished material.

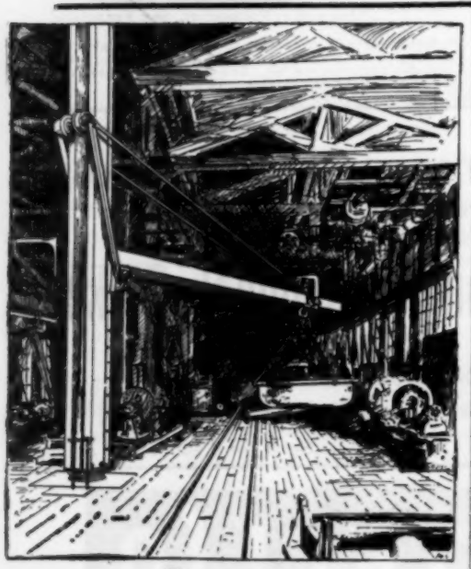
Car and locomotive building, noted in the *Railroad Gazette*: The Lake Superior & Ishpeming has bought 400 ore cars. The Ohio River road will buy 300 freight cars. The Long Island has ordered 50 cars from the Lebanon Mfg. Co. Of 2,200 cars given out by the Erie road, the Michigan & Peninsular Car Co., got 1,700 and the Union Car Co., Buffalo, 500. Of the New York Central's order the Barney & Smith Mfg. Co. has taken 400, the Union Car Co., 500, and the Buffalo Car Mfg. Co., 1,250. The Lehigh Valley has placed five engines with the Baldwin Locomotive Works; the Schenectady Locomotive Works are building 10 for the Adirondack & St. Lawrence; and the Pittsburg Locomotive Works have the order for 10 for the Lake Superior & Ishpeming.

The offer of the Davis & Egan Machine Tool Co. (formerly the Lodge & Davis Co.) to present a nickel and gold plated lathe to the most popular mechanical school in the United States has given rise to a very lively and interesting contest. Thousands of votes are coming in from all parts of the country. Several presidents of railroads have gone in with a determination to win the prize for their favored school and have placed large supplies of tickets in the hands of their agents along their respective lines with the instructions to make a vigorous campaign. Students of the various schools are going about soliciting votes on long lists. One young man is credited with having turned in to his school a list containing the names of 5,000 voters. A number of schools are soliciting votes through the medium of the daily newspapers, others are sending out circular letters. The contest will close on March 1, 1896, at 12 o'clock.

Steam Yachts and Marine Machinery,

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

16 Months in Constant Use,
And still in GOOD CONDITION in Cupola melting 10 tons per day,
Is on Record For
THE ACME
CUPOLA BLOCK
The ACME Saves You Money Every Time.
HIGH GRADE FIRE BRICK ANY SIZE AND SHAPE.
Cheap Fire Brick. Fire Clay, Crude, Ground or Calcined.
THE OHIO SAND & CLAY CO.,
305 KIMBALL STREET, - - COLUMBUS, OHIO.
Write us for Prices and Full Information.



Cranes,
Hub and Flange Pipe.
For special information and prices, write to
The Addyston Pipe and Steel Co.,
Cincinnati, O.

THE BOURNE-FULLER CO.,
Pig and Bar Iron,
CLEVELAND, . OHIO.
If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

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The Industrial Centre of Chicago
offers Free Factory Sites and other inducements.
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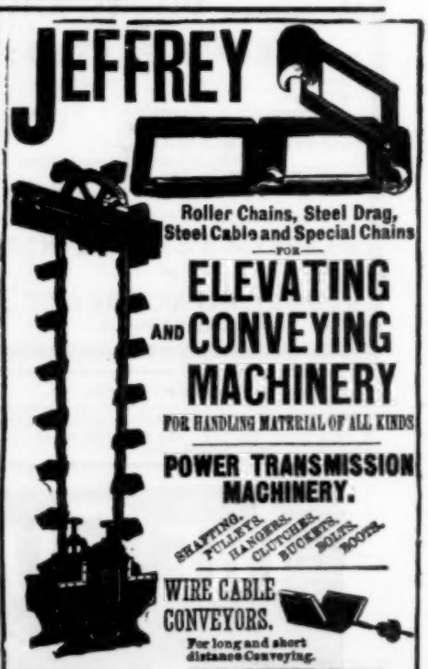
Chicago Heights Land Association
M. H. KILGALLEN, Gen'l Mgr. CHICAGO

JEFFREY

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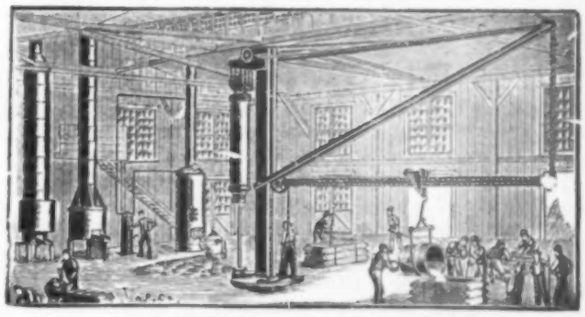
WIRE CABLE CONVEYORS.
For long and short distance Conveying.
THE JEFFREY MFG. CO. Columbus, Ohio.
163 Washington St. NEW YORK.
Send for Catalogue.

We're Doing All We Can to Wake You Up.

Some time ago we mentioned the fact that the Grays' Ferry Foundry Co., of Philadelphia, had equipped their Foundry with Ridgway Cranes. A few weeks ago we also noted that Robt. Wetherill & Co., of Chester, Pa., happening to drop in at the Grays' Ferry plant and seeing the cranes, had immediately sent for us and given us the order for their shops.

Now comes Mr. Henry Julian, President of the Grays' Ferry establishment, to inform us that he is going to double the size of his shops and will want another outfit of RIDGWAY CRANES.

"What! Going to build a new foundry and not put in an electric traveller, as so many are doing? Can it be possible?"



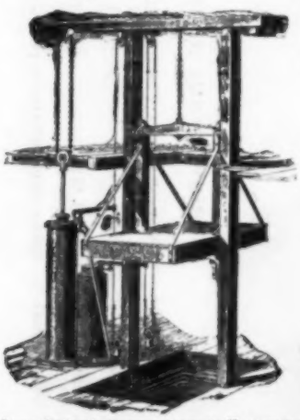
5-ton Steam-Hydraulic Crane in a Foundry.

Quite possible. You see the Grays' Ferry Foundry is not run by them as a convenience, like your foundry. They don't have a machine shop to consume castings and can't be satisfied if castings cost no more than they can buy them for. They make castings for the public. They have to make castings for other machine shops cheaper than they can themselves make them. Hence they use Ridgway Cranes now and are going to get more. They run their foundry for money and not for style.

A traveller is fine for taking loads up and down the shop—and getting balky occasionally. The money is not made in a foundry taking things up and down the shop, but in the molders getting molds made quick and having the castings good when made A good track and a truck on the floor will move the loads all right, and the crane—if it's a RIDGWAY CRANE—will lift the copes, draw the patterns, handle the molds and make the molders make money.

The Grays' Ferry concern put in RIDGWAY CRANES and now take the general foundry trade of the city. To keep up they must double up.

But you—you run your foundry for fun, just to keep your machine shop in castings, perhaps. Anything in the way of a crane suits you. But people who want to see a nice profit from the foundry are getting RIDGWAY CRANES and are not being disappointed in the profit.



Steam-Hydraulic Elevator, also made direct acting with cylinder under platform.

"PLEASE TAKE THE ELEVATOR."

If You Are Up on Elevators, You Will.

Direct Acting Steam-Hydraulic Elevator.

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Findlay, O.

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For Hydraulic Tubes, Jacks, Presses and Hoists, Lathe Spindles, Bicycle Hub Stock, Projectiles, Hollow Shafting, Shells for Carbonic Acid and other Gases, Piston and Valve Rods, Axles, Bolts and Columns, Working Barrels, Roller Bearings, Bushings, Couplings, Boiler Tubes and other purposes where

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Our tubes are hot drawn, without weld or seam; from the best quality of steel, in lengths from 8 to 25 feet, and of any degree of hardness, from .08 to .60 carbon —They are equal in every respect, except finish, to cold drawn tubes and are offered at a much lower price.

For special work, requiring extremely low sulphur and phosphorus, we are prepared to guarantee a maximum of

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—MANUFACTURERS OF—
AUTOMATIC MOLDING MACHINES,
For Sand Molds for Metal Castings.

Note the advantages of the **only Power Molding Machine adapted to different sizes and shapes of flasks.**

Our 16″ Duplex will mold, working Duplex, both parts of flask 12″x16″ and all sizes below; this same machine, when working Single will mold flask 16″x20″ and all sizes under.

Our 20″ Duplex will mold, Duplex, both parts of flask 13″x18″ and all smaller sizes; working Single it will mold flask 18″x24″ and smaller sizes.

This feature allows a range of work, by one of our Machines, which would require a number of any other type. This is of the greatest importance to Foundries.

The Milling Machine of the Foundry.

AUTOMATIC DUPLEX MOLDING MACHINE.

These machines are adapted to general castings when made in reasonable quantities.

The use of these machines is a guarantee of economy, greater quantity and better quality in castings.

Foundrymen who are interested in producing cheap castings of superior quality are invited to correspond with the Company and call at the works, Front and Franklin Streets, Elizabeth, N. J., and see the machines in operation.

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CLASS A AND CLASS B.

ECONOMIC, SAFE AND DURABLE.

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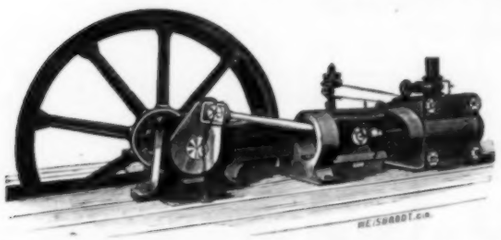

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ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

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Four Types and Eight Sizes for ELECTRIC AND OTHER POWER.
SINGLE AND DOUBLE-ACTING CYLINDERS.

Unequaled in Design and Construction.

Adapted for Water Works, Hydraulic Elevators, Boiler Feeding, Apartment Houses, Mine Pumping, Irrigation, Paper Mills, Refineries, Breweries, Etc.

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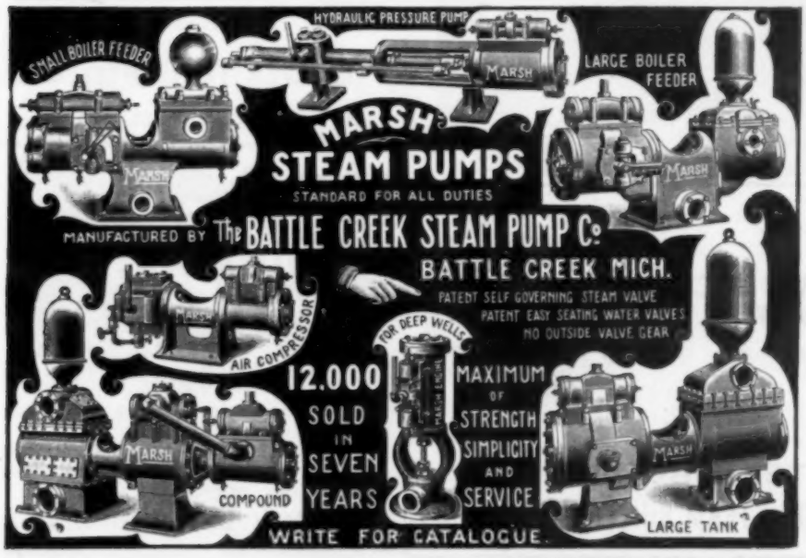

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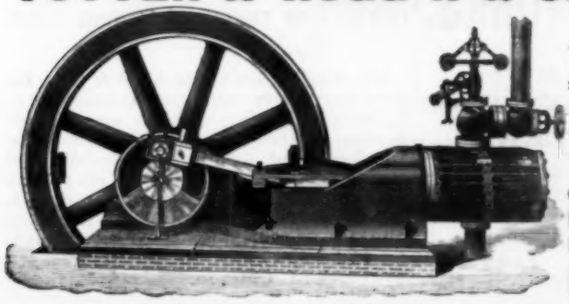

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Simple, Compound, Triple expansion, Condensing and non-condensing.

The best engine for any service where high economy and close regulation are desired. Compact in form and durably constructed. Specially adapted to driving electric generators direct connected and by belt. Also for rolling mill work.

BLOWING ENGINES, REVERSING ENGINES, CENTRIFUGAL PUMPS.

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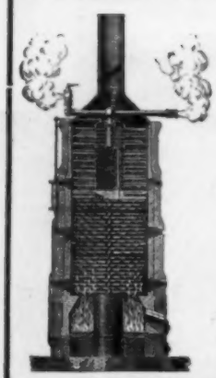

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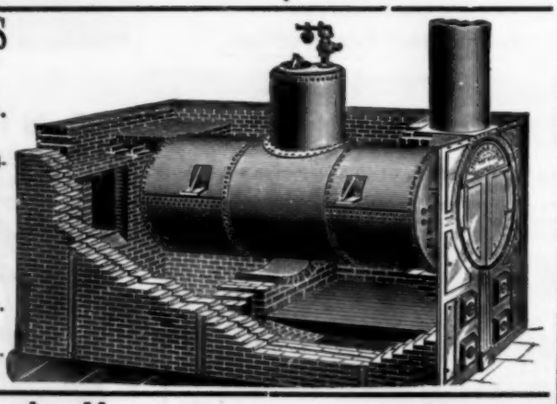
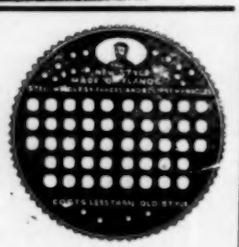


Being in the boiler business

For a long time,

We have learned that HEATING SURFACE does not always mean HORSE POWER;

It depends upon getting the HEAT to the SURFACE.



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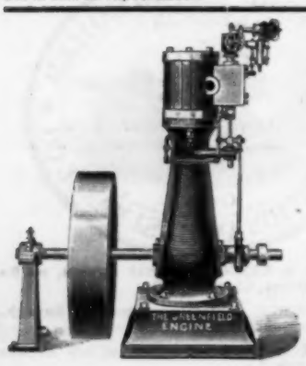

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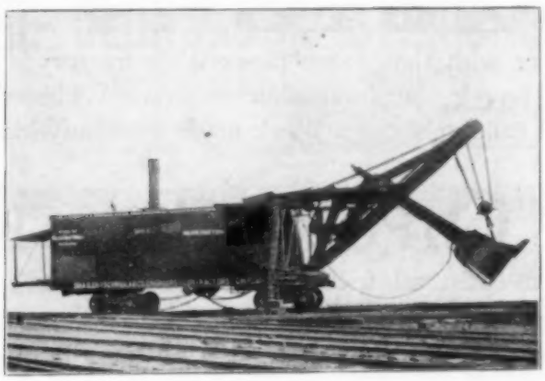

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60-inch Locomotive Boiler,
Double 12x12 Engine,
Double 9x9 Crane Engine,
Heavy Power Jacks, Independent.
Steel Dipper Handle,
2 1-2 Yard Dipper.
65 tons shipping weight.

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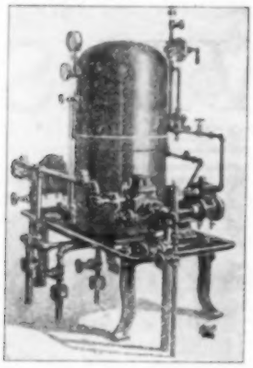

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Heats and cleans the oil and delivers it to the fires under high and uniform pressure.

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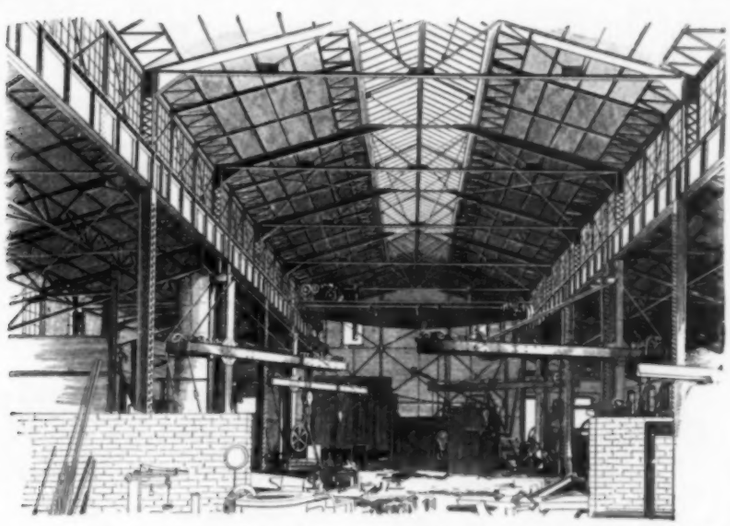
THE Berlin Iron Bridge Co.

Engineers, Architects and Builders of Iron and Steel Structures.



The above illustration is taken direct from a photograph and shows the interior of a Foundry Building, which was designed and built by us for the S. F. Hodge & Co., at Detroit, Mich. Each wing is 24 ft. in width and the central portion is 40 ft. in width, this latter controlled by a Crane with a travel the full length of the building. The crane girder posts are designed to carry jib posts as shown. The roof is covered with our Patent Anti-Condensation Corrugated Iron. The building is absolutely fire-proof, and the corrugated iron is guaranteed not to drip during the co'dest weather.

OFFICE AND WORKS:

EAST BERLIN, : : : : : : : : CONN.

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will entertain propositions for the sale, or lease of their Furnace Plant and Iron Mines.

Or will also entertain propositions for the loan of $80,000 on bonds secured by a first and only mortgage upon the whole property.

The directors of the company will hold a special meeting on Tuesday, the 17th day of March, 1896, to consider and pass upon all propositions presented.

The property consists of 110 acres of land in the city of Greensboro, N. C., on which is erected a Blast Furnace of the latest and most improved style, having a capacity of 125 tons per day, ready to operate; and 1,700 acres of Mineral Lands, located on the C. F. & Y. V. Railway, forty miles from the furnace.

All communications addressed to

COL. J. D. KASE,
General Manager,
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will have respectful and prompt acknowledgment, and be placed before the Board of Directors.

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Cleveland - Ohio.

ESTABLISHED 1854.

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REFRACTORY.

That's what's the matter with that stove pipe; it's refractory! So is our **Cupola Block,** but in another way (see Webster's definition.) We are not talking about a Block made from any kind of Clay, but about our

COLLIAU CUPOLA BLOCK

which is strong enough to resist all friction, and refractory enough to withstand the heat at time of melting. It is made from Kentucky Clay and is all right.

Another thing: Our **STAMPED STEEL HAND LADLE** weighs but three pounds and is another up-to-date production. We have "**Everything for a Foundry.**"

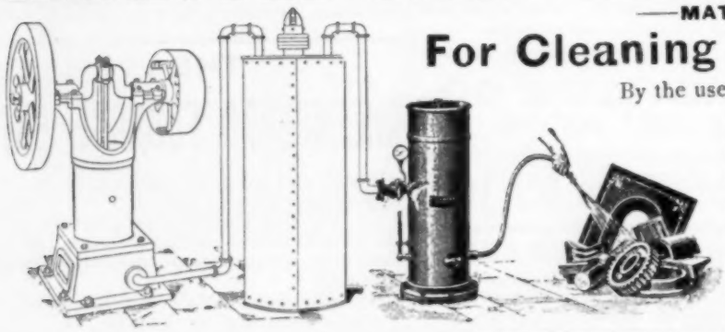
90 GRISWOLD STREET,
11-13 ATWATER ST., W.

F. B. STEVENS,

DETROIT . . MICH.

IMPROVED SAND BLAST APPARATUS,

—MATHEWSON'S PATENT—



For Cleaning Castings, Forgings, etc

By the use of common, sharp, dry sand, and with a compressed air pressure of 15 lbs., this Apparatus will **Clean** all forms of castings **more thoroughly** than is possible by hand, for **half the total cost**, and in a space of time that cannot be conceived until the machinery has been seen in actual operation. For small castings a special tumbling barrel is worked in connection with the Sand Blast Apparatus. For further particulars apply to

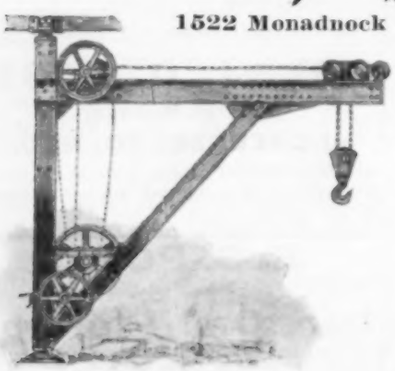
WARD & NASH, Agents.

23-25 Purchase St., Boston. **35-37 South Canal St., Chicago.**

Whiting Foundry Equipment Co.

1522 Monadnock Block, CHICAGO.

Works: HARVEY, CHICAGO SUBURB.



We make all types of **TRAVELING** and **CIB CRANES** for all Purposes. Send for Circular. New Designs.

Remember us when you need a Cupola.

THE "WHITING"

Ladles, Elevators, Air Hoists, etc.

Send for Circulars.

CHICAGO HEIGHTS

The Industrial Centre of Chicago

offers **Free Factory Sites** and other inducements.

If you are seeking a new location it will pay you well to investigate the merits of our proposition.

Chicago Heights Land Association

M. H. KILGALLEN, Gen'l Mgr. CHICAGO

The Best Flux known for Welding

IRON TO IRON, Manufactured in Cherry Heat Welding Compound NEW YORK CITY STEEL TO STEEL

AND

Malleable Iron to Steel.

IMPORTER AND JOBBER OF PURE REFINED BORAX.

—ONLY—

Welding Compound

AWARDED MEDAL AND DIPLOMA AT WORLD'S FAIR, CHICAGO.

One Pound Tin Mailed on Receipt of 30c.

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MANUFACTURED ONLY BY

CORNELIUS S. MITCHILL,

Office and Factory,
545-549 W. 22nd St., NEW YORK, N. Y.

Subscribe for THE IRON TRADE REVIEW, $3.00 per year.

THE CLONBROCK STEAM BOILER CO.,

BROOKLYN, N. Y.

MANUFACTURERS OF

THE MORRIN "CLIMAX" AND "COMPOUND" WATER TUBE BOILERS.

No Screw Joints. No Metallic Joints. No Ground Joints. No Packing Joints. No Cast Iron Pipes, Manifolds or Headers to cause trouble from Unequal Expansion or Contraction.

QUICK AND STEADY STEAMERS, POSITIVE CIRCULATION.

THE "CLIMAX" IS BUILT IN UNITS OF 50 TO 1000 H. P.
THE "COMPOUND" IS BUILT IN UNITS OF 50 TO 500 H. P.

Specifications, Blueprints, Etc., Furnished on Application.

SEND FOR "CLIMAX" and "COMPOUND" CATALOGUES

CLEVELAND

.. GALVANIZING ..

WORKS.

Galvanizing in all its branches. Highest prices paid for new Scrap Zinc. When in the market for Pump Chains and Rubber Buckets write us for prices.

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PHOENIX PORTABLE POWER TOOLS.

For Drilling, Reaming, Tapping, Countersinking, Etc. Guaranteed to Develop More Power With Less Air than Any Other Tool on the Market.

TWO SIZES:
No. 1 Weighs 28 Pounds.
No. 3 Weighs 38 Pounds.

OPERATED BY

Compressed Air.

Send for Circular and List. Firms Using These Tools.

EVERY CONCERN USING THESE TOOLS SAVING BIG MONEY COMPARED WITH HAND LABOR.

Patented Mar. 28, '93, April 30, '95.

Correspondence Solicited.

C. H. HAESELER & CO.

No. 1001 HAMILTON STREET, PHILADELPHIA, PA.

LOCATIONS FOR INDUSTRIES.

The name of the Chicago, Milwaukee & St. Paul Railway has long been indentified with practical measures for the general upbuilding of its territory and the promotion of its commerce, hence manufacturers have an assurance that they will find themselves at home on the company's lines.

The Chicago, Milwaukee & St. Paul Railway Company owns and operates 6,154 miles (9,900 kilometers) of railway, exclusive of second track, connecting track or sidings. The eight States traversed by the lines of the company, Illinois, Wisconsin, Northern Michigan, Iowa, Missouri, Minnesota, South Dakota, and North Dakota, possess, in addition to the advantages of raw material and proximity to markets, that which is the prime factor in the industrial success of a territory—a people who form one live and thriving community of business men, in whose midst it is safe and profitable to settle. Many towns on the line are prepared to treat very favorably with manufacturers who would locate in their vicinity.

Mines of coal, iron, copper, lead and zinc, forests of soft and hard wood, quarries, clays of all kinds, tan-bark, flax and other raw materials exist in its territory in addition to the vast agricultural resources.

A number of new factories have been induced to locate—largely through the instrumentality of this company—at towns on its lines. The central position of the States traversed by the Chicago Milwaukee & St. Paul Railway, makes it possible to command all the markets of the United States. The trend of manufacturing is Westward. Nothing should delay enterprising manufacturers from investigating. Confidential inquiries are treated as such. The information furnished a particular industry is reliable.

Address LUIS JACKSON,
Industrial Commissioner, C., M. & St. P. R'y.
425 Old Colony Bldg., CHICAGO, ILL.

S. FIX SONS'

STEAM TUBE WELDING WORKS.

Manufacturers of reworked boiler tubes. Good second-hand tubes bought.

CLEVELAND, O.

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THE IRON TRADE REVIEW.

Sheet Metal Working Machinery.

Compound Lever Sheet Iron Shears, all sizes. Seven different styleSquaring Shears and Punches. Crimping, Forming and Straightening, Rolls, etc.

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CHICAGO HEIGHTS

The Industrial Centre of Chicago

offers **Free Factory Sites** and other inducements.

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SOLID STEEL SHEAR KNIVES

Made of the Best Crucible Tool Steel.

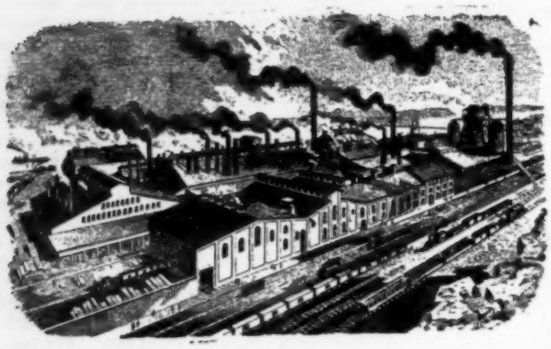
MANUFACTURED BY
SAMUEL TRETHEWEY & CO.
LIMITED.
47th St., PITTSBURG, PA.

HARDENED FORGED STEEL RAILS

PITTSBURG STEEL & IRON MFG. CO.

PITTSBURG, PA.

Successors to MOOREHEAD-McCLEANE CO.



SOHO CHB TRADE MARK

Having purchased, repaired and put in operation these well known works, we are prepared

TO FILL ORDERS PROMPTLY.

We are Manufacturers of

BESSEMER PIG IRON AND OPEN HEARTH STEEL.

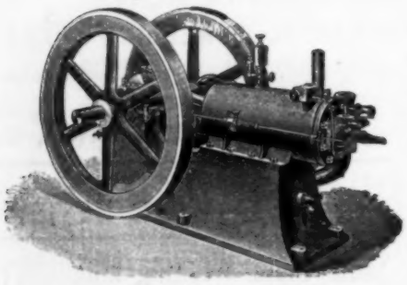
—AND WE—

ROLL and SHEAR PLATES to DIMENSIONS. Write Us.

Don't Waste Money in Your Pattern Shop.

THE GOBEILLE PATTERN CO., Cleveland.

The Chicago Gas and Gasoline Engine



The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength. Catalogue sent on application.

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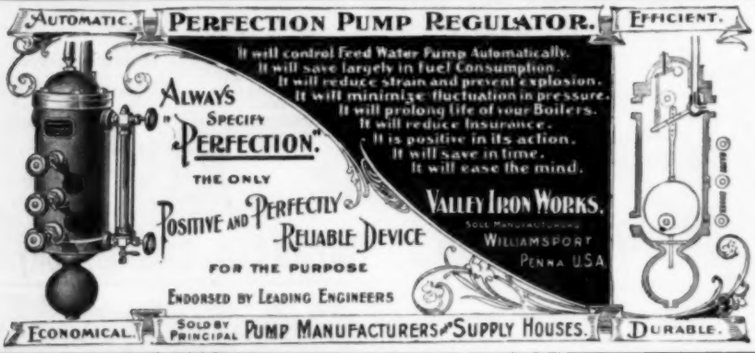
J. J. NORMAN CO.,
60 South Clinton Street,
CHICAGO ILL.

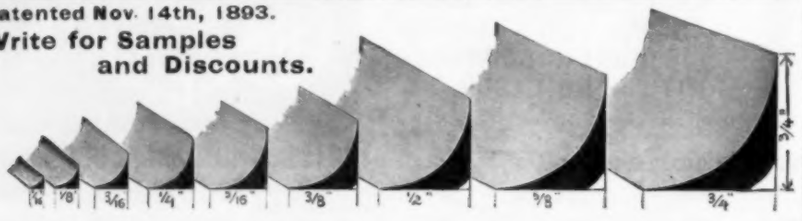
AUTOMATIC. PERFECTION PUMP REGULATOR. EFFICIENT.


It will control Feed Water Pump Automatically.
It will save largely in Fuel Consumption.
It will reduce strain and prevent explosion.
It will minimize fluctuation in pressure.
It will prolong life of your Boilers.
It will reduce Insurance.
It is positive in its action.
It will save in time.
It will ease the mind.
ALWAYS SPECIFY "PERFECTION."
THE ONLY POSITIVE AND PERFECTLY RELIABLE DEVICE FOR THE PURPOSE
ENDORSED BY LEADING ENGINEERS
VALLEY IRON WORKS.
WILLIAMSPORT PENNA. U.S.A.

ECONOMICAL. SOLD BY PRINCIPAL PUMP MANUFACTURERS & SUPPLY HOUSES. DURABLE.

Patented Nov. 14th, 1893.

Write for Samples and Discounts.



PATTERN MAKERS AND FOUNDERS

Should use none but the BELDING PATENT LEATHER FILLET, the only one made scientifically correct. Quickly applied to any corner, straight surface single or compound curves, wood or iron, without nails or clamps. Once used, always used. Send sample order. Proper Discounts will be Allowed You.

THE CANTON LEATHER FILLET CO., Canton, Ohio.

A POOR WHEEL is like a poor horse—it costs more than its worth to keep it.

In the Monarch the necessity of repair has been reduced to a minimum. Its strength, lightness, and beauty make it a marvel of modern mechanical skill.

The Monarch

IS UNDOUBTEDLY KING OF WHEELS

A wheel that you can depend upon in any emergency. Made in four models—$80 and $100. The "Defiance"—made in eight models—$40, $50, $60 and $75. Send for the Monarch book.

Monarch Cycle Mfg. Co.,
Chicago, Ill.
83 Reade Street, New York.
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ONE YEAR, $3,

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Write for Estimates on all kinds of Engravings.

Dangler Electric Torches,

For GASOLINE or OIL.

Especially adapted for DOCK and out door use, as well as for lighting manufacturing establishments, such as Rolling Mills, Foundries, Machine Shops, Engine rooms, etc., etc., being a

Convenient, Portable, Brilliant Light.

Sole manufacturers

—THE—

Dangler Stove & Manufacturing Co.

Cleveland, O.

The Guarantors

LIABILITY INDEMNITY COMPANY OF PENNSYLVANIA.

RICHARD F. LOPER, General Manager, Philadelphia. Pa.

Employers' Liability Insurance, Workman's Benefit Insurance, Steam Boiler Insurance.

STATEMENT, DEC. 31, 1895.

ASSETS.

Real Estate owned by Company	$250,000 00
Loans on Bonds and Mortgages on Real Estate	144,426 36
United States Government 5 per cent Bonds	115,000 00
Passenger Railway 1st Mortgage Bonds	114,000.00
Philadelphia, Penna., City Loans	65,100.00
Brooklyn, N. Y., 4 per cent City Loans	46,800.00
City of Toledo, O., 4 per cent Park Bonds	22 000.00
City of Gallipolis, O., 5 per cent Bonds	12 500.00
City of Wooster, O., 5 per cent Bonds	11, 00 00
County of Putnam, O., 5 per cent Bonds	11,000 00
City of Richmond, Va., 4 per cent Bonds	15 000.00
City of Norfolk, Va., Bonds	13,750.00
City of Johnstown, Pa., 4½ per cent Bonds	9,950.00
City of Scranton, Pa., 4½ per cent Bonds	5 500.00
Lehigh Valley R. R. 6 per cent Annuity Bonds	15,240.00
Penna. & N. W. R. R. 5 per cent Bonds	10 250.00
Other Bonds owned by Company	21,025 00
Loans on Approved Collaterals	68,148.02
Net Premiums in Course of Collection	142,951.55
Cash in Banks and Company's Offices	90,383.04
Accrued Interest	8,867 45
Amount of Losses Returnable to Co. on Agreed Settlements	14,039.77
Office Furniture and Fixtures, Appraised	5,199.04
TOTAL ASSETS	$1,182 530.23

LIABILITIES.

Total losses adjusted, unpaid		$1,648.67
Total Claims in process of adjustment, (amount claimed in full		1,098.49
Claims resisted or in suspense		19 000.90
Special Reserve Fund to meet unascertained claims	$119,336 10	
Less re-insurance	2,902.77	
		116,433.33
Re-insurance reserve to cover all outstanding risks		282,982.02
Reserve for all other liabilities		152,588 98
Capital Stock		500,000.00
NET SURPLUS		108,781.74
		$1,182,530.23

Deposited with State Insurance Departments for the Protection of Policy-holders,

$288,930.00.

We call your attention to the following letters from well-known firms:

THE PHILADELPHIA BRIDGE WORKS.

The Guarantors of Penna., Philadelphia, Pa.:

Gentlemen: We take pleasure in commending your company upon their methods of transacting business with our company, both as to the satisfactory handling of all claims in cases of accidents and the quick dispatch with which such matters are executed. Since we have been policy holders we have had quite a number of accidents occurring to our employes, and in all cases they have received prompt action and fair settlement.

Prior to our connection with the Guarantors we were insured in two different Employers' Liability Companies, and whilst in the case of one company we received fair treatment, neither of them were so satisfactory as The Guarantors. With the present management we expect to continue our relations with you, and we will be glad to recommend your good business principles and ability to any one who may ask information of us. Yours truly, COFRODE & SAYLOR, INCORPORATED.

By P. R. FOLEY, Cashier. JOSEPH H. COFRODE, } Receivers, WILLIAM F. HARRITY, }

CHICAGO BREWING COMPANY,

CHICAGO, ILL.

The Guarantors' L. I. Co.:

Gentlemen: At several occasions we have noticed the promptness with which you settled just claims, and it gives us great pleasure to express our thanks with assurance that you shall be recommended where ever and when ever we have an opportunity. Respectfully yours,

CHICAGO BREWING COMPANY.

THE CHRISTIAN MOERLEIN BREWING COMPANY,

CINCINNATI.

The Guarantors' L. I. Co.:

Gentlemen: This company has been insured by The Guarantors' L. I. Co., of Philadelphia, for nearly two years, covering the Employers' Liability, teams, and half wages, etc., to employes, and we take pleasure in saying that all claims against them have been promptly settled and paid to our entire satisfaction. Yours truly,

THE CHRISTIAN MOERLEIN BREWING CO.

The Guarantors' of Pennsylvania, U. S. A.:

Gentlemen: We take pleasure in the acknowledgment that your cheerful and prompt adjustment of claims covered by our policy with your company has been such as to inspire perfect confidence and comfort in the matter of casualty insurance. We are perfectly satisfied.

Yours respectfully, WM. A. AVIS & CO.

91 Front St., New York City.

THE CLEVELAND HARDWARE COMPANY,

CLEVELAND, O., Dec. 9, 1895.

Geo. G. Brown, Agent, Guarantors' Liability Idemnity Co.:

Dear Sir: In regard to the policy we have with the Guarantors' would say that we have had this policy for about a year now, and our dealings with the company have been satisfactory in every respect. The claims which we have made upon them, which have been quite numerous, have been promptly paid and the service and attention we have had has been entirely satisfactory. Yours very respectfully,

THE CLEVELAND HARDWARE CO., M. C. L.

By CHAS. E. ADAMS, Manager.

PEOPLES BANK,

PHILADELPH'A, Jan. 16, 1896.

Tod Ford, Esq., Youngstown, O.:

Dear Sir: We consider The Guarantors thoroughly reliable in every way. Their capital is $500,000 and surplus nearly that amount. Their investments for the security of their policy-holders consist of the finest lot of bonds that the writer ever saw, viz: U. S. Government, City of Philadelphia, City of Brooklyn, etc. In fact we would quote them "A 1."

Yours tru'y, JNO. L. HOPKINS, Cashier.

ÆTNA-STANDARD IRON & STEEL COMPANY,

BRIDGPORT, OHIO, Dec 9, 1895.

Mr. Geo. G. Brown, District Manager G. L. I. Co. Youngstown, O.:

Dear Sir: We are in receipt of your favor of the 7th inst. Your treatment of us during the past year has been very satisfactory, and we have no occasion to feel otherwise than friendly to your Company. We are now negotiating for renewal of our accident insurance for this year, and we trust that your company may be successful in obtaining it.

Yours truly, ÆTNA-STANDARD IRON & STEEL CO.

By J. J. HOLLOWAY, Treasurer.

CLEVELAND CITY FORGE & IRON COMPANY,

CLEVELAND, O., Dec. 9, 1895.

Geo. G. Brown, District Manager G. L. I. Co., Cleveland:

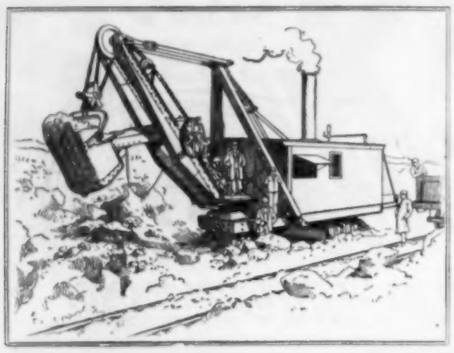
Dear Sir: We have yours of the 9th, and note contents. We are very pleased to state in answer to your letter that since the agency of the Guarantors' Co. has been put into your hands in Cleveland, we hear nothing but the very kindest words for your management, and no doubt had you had the agency right along, we should still have been with you. We regret that the unfortunate action of one of your former agents' [sub-agents] should in any way have prejudiced your interests with us. We shall be very pleased to figure with you when our policy matures again, and see no reason why at competition rates we should not favor you with our business. Congratulating you on the success you have met so far, we are, Respectfully, CLEVELAND CITY FORGE & IRON CO.,

R. A. HARMAN, Assistant Manager.

Such settlements as above show why our Policies are taken in preference to those of any other company, and when policy holders have investigated fully our claims they will find that we are justly entitled to the leadership in this line of insurance. Full information furnished upon application to

GEO. G. BROWN, District Manager, 201 CUYAHOGA BUILDING, CLEVELAND, OHIO.

TELEPHONE 4008.



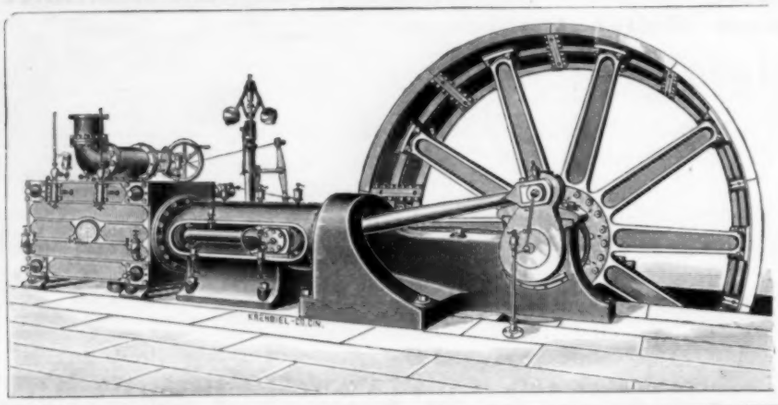
Bucyrus Steam Shovel & Dredge Co.

JOHN S. GEORGE and HOWARD P. EELLS, Receivers.

STEAM SHOVELS	Five sizes for every purpose. Standard Railroad Shovels. Special Shovels to order.
DREDGING MACHINES	More than 20 sizes in all types. Dipper, Elevator, Hydraulic, to suit any requirements.
GOLD SAVING MACHINERY	For Placer Mining. With steam shovels and appliances for disposal of tailings.
WRECKING CRANES	Hand or Steam, 5 to 35 tons capacity. Also Locomotive Cranes and Pile-Drivers.
CENTRIFUGAL DREDGING PUMPS	6-inch to 36-inch. With either simple compound or triple engines.

SOUTH MILWAUKEE, WIS.

THE HOOVEN, OWENS & RENTSCHLER CO., Hamilton, O.

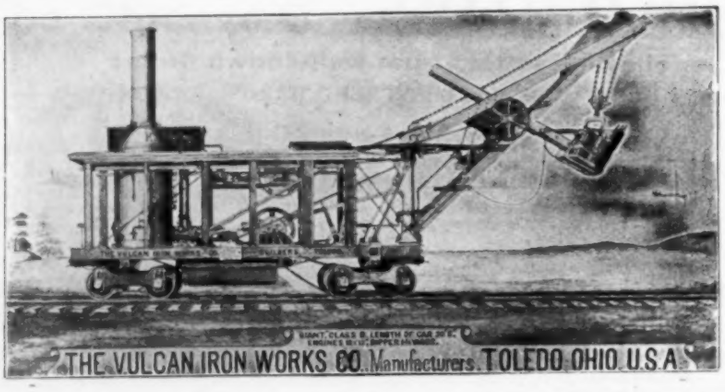


Hamilton Corliss Engines.

Engines for Rolling Mills, Electric Railways and Electric Light.

Engines of all Sizes and for all purposes.

46 South Canal St., CHICAGO.
39 and 41 Cortlandt St., NEW YORK.
Lewis Block, PITTSBURGH, PA.
Room A, Laclede Building, ST. LOUIS, MO.
C. C. MOORE & CO., SAN FRANCISCO, CAL.



STEAM SHOVELS!

VULCAN IRON WORKS CO.,

TOLEDO, O., U. S. A.

There is no Steam Shovel on the market so well adapted to handling Iron Ore as our "Giant." We guarantee 2,500 tons in ten hours.

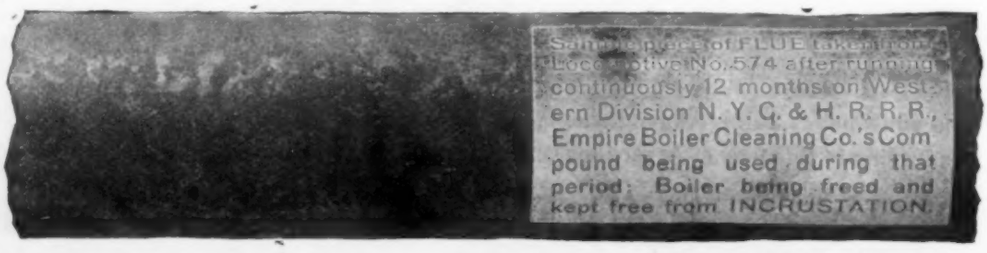
Our "Giant" has the record on the Mesabi Range.

LOOK AT THIS!

Sample piece of FLUE taken from Locomotive No. 725 running for 7 months on Western Division of N. Y. C. & H. R. R. R. showing amount of SCALE adhering in that time.

If you desire further information, send for our circular which goes into the subject with cogent reasoning, as well as scientifically, corroborated by testimonials, any of which would convince a practical mechanic, but as "seeing is believing," send in your orders and save time, trouble and money by commencing the use of this known valuable **COMPOUND** at once. Canned in five-pound tins and packed in 100-pound cases, for Land Boilers, price $20 per case. Canned in one-pound tins and packed in 50-pound cases, for Locomotive Boilers, price $25 per case.

Delivered free to any Railroad Station in the United States. Should we not be represented in your town, and should you be well up in the machinery line, we are looking for agents.


Sample piece of FLUE taken from Locomotive No. 574 after running continuously 12 months on Western Division N. Y. C. & H. R. R. R., Empire Boiler Cleaning Co.'s Compound being used during that period. Boiler being freed and kept free from INCRUSTATION.

The Empire Boiler Cleaning Co., 19 Whitehall St., NEW YORK CITY. ...AND THEN AT THAT.

Cleveland Agent—ALEX. C. BATES, 35 Wade Bldg., Cleveland, O.

T. P. KELLY & COMPANY,

MANUFACTURERS OF THE CELEBRATED

"B. M." brand of Plumbago,

Grinders of all kinds of FOUNDRY FACINGS and BLACKINGS. Dealers in FOUNDRY SUPPLIES.

Mills at Reissing, Pa., and Bloomsbury, N. J.

New York Office, 284 Pearl Street.
Chicago Office, 121-127 N. Ada Street.

Write for samples of our "B. M." brand of Plumbago.

ROYAL LEAD,

A COMBINATION OF

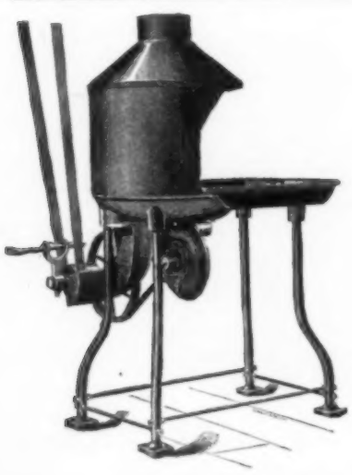
EAST INDIA PLUMBAGO AND SILVER LEAD.

FINELY GROUND AND BOLTED.
A SPLENDID MIXTURE FOR FOUNDRY USE. Price, 3 cts. per pound, by the Barrel.

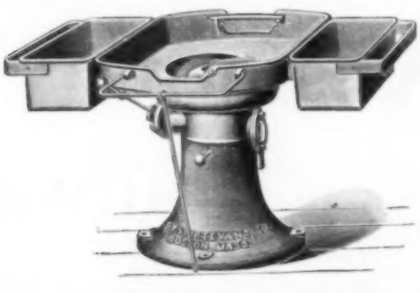
THE

J. D. Smith Foundry Supply Co.

2134 Central Avenue, Cincinnati, O.



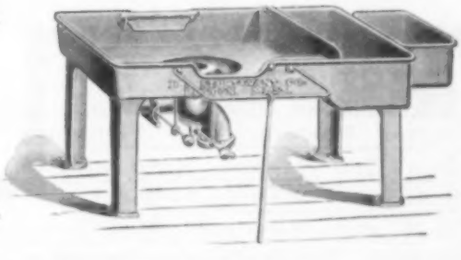
STURTEVANT FORGES



40 SIZES and STYLES.

PRICES REDUCED.

Send for Catalogue No. 77.



B. F. STURTEVANT COMPANY,

34 Oliver St., Boston, Mass.
131 Liberty St., New York, N. Y.
16 South Canal St., Chicago, Ill.
135 North Third St., Philadelphia, Pa.

75 Queen Victoria St., London, E. C., England.
21 W. Nile St., Glasgow, Scotland.
87 Zimmerstrasse, Berlin, Germany.
2 Kungsholmstorg, Stockholm, Sweden.

The Shaw Electric Crane Co.

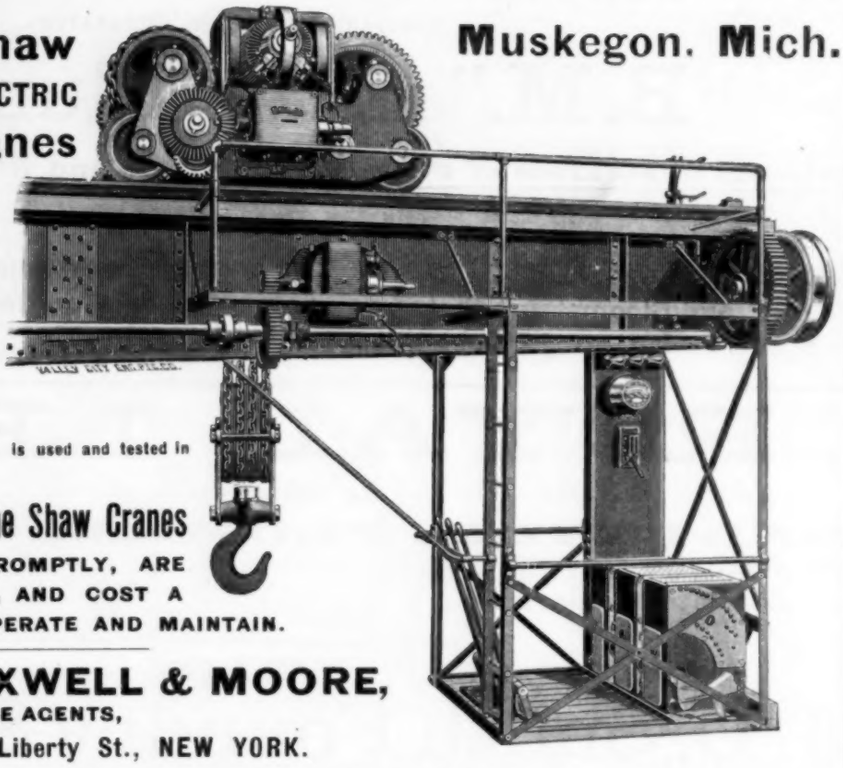
BUILDERS OF THE

Celebrated Shaw

THREE MOTOR ELECTRIC

Traveling Cranes

Muskegon. Mich.



The (3 Motor Crane) is the only Crane to be CONSIDERED or USED

IT IS A FACT,

In every instance where the

SHAW CRANE is used and tested in comparison with other makes

It is Demonstrated that the Shaw Cranes

DO THE WORK MORE PROMPTLY, ARE MORE EASILY HANDLED, AND COST A GREAT DEAL LESS TO OPERATE AND MAINTAIN.

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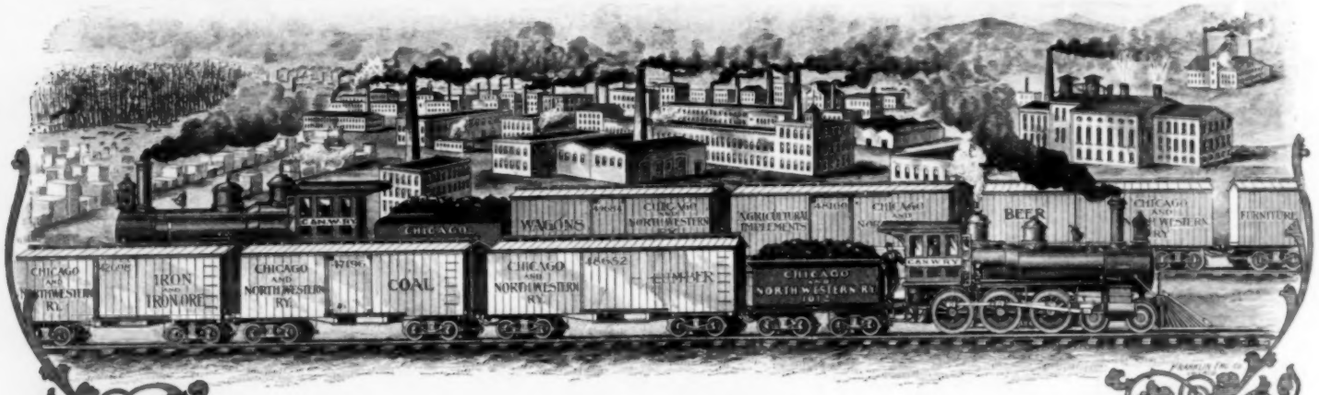

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By the use of John Adt's Aut. Wire Straightening and Cutting Machines, Elastic Rotary Blow Riveting Machines and Tools, we have raised the standard of our work and increased our sales, for by their modern construction and time saving devices, the great production and good quality of work has enabled us to quote prices by which our customers would buy in large quantities.

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Others say they would have none other than John Adt's Machines and Tools. (This is the good news we are continually receiving.)

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Estimates and advice as to manufacture of any articles furnished. Correspondence solicited. Give us a trial and be convinced.

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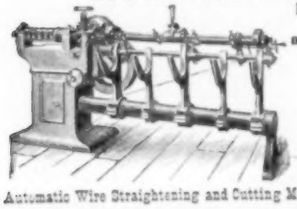

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Planer 42"x36"x Planes 18'. Good and heavy,	$650
" 29"x22"x " 7'. Good with chuck,	290
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Bolt Cutter (New), ½ to 1½ Complete	190
Engine, Extra Fine, 75 H. P.	300
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Lathe 28"x11' bed. Almost new. Heavy	450
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Turret lathe Amer. T. & M. Co., new modern,	260
Gas Engine, Otto, New, 16 h. p. gas or gasoline	700
" " " " 12 " " "	600
" " " " 10½ h. p. for Gas only	300
Punch Press & Shear combined, new, 3,000 lbs	210
" " Stiles & Parker design, 1500 lbs	135
" " " " 1250 "	124

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Steel Stamps and Stencils.

FULKHARTY, J. H. & Co., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

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ENGINE LATHES.

12x5 Ames with chuck.
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16x7 Pond, rise and fall rest.
18x6 New Haven, rod feed only.
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60" Henley Pulley Lathe.

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24"x24"x6' Pease, almost new, with chuck.
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3 Spindle Garvin Gang Drill.
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24" Hendey Shaper.
Power Broaching Press.
2 Spindle profiling machine.
10' Universal Radial Drill.
Double column Blanking Press.
Double end Punch and Shear for shearing ⅝" iron.
1 Williams & White Power Hammer, in fine order.
1 1½" Double Head National Bolt Cutter, in fine order.

Above tools are in good condition; photographs will be sent on application. Write for our catalogue for Bicycle Repair Shops.

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An Iron Roof.

We have on hand for immediate delivery, an iron roof 121' 3" wide out to out by 220' long which until lately has been used over a Foundry It is in good condition. The roof covering, which will be new, can be supplied to suit the requirements of the purchaser. The length of roof can be varied slightly either way.

Shiffler Bridge Company

PITTSBURGH, PA.

FOR SALE

AT A BARGAIN.

One second-hand Robison-Rea Co. blowing engine. Size 72" blowing tub, 36" steam cylinder, four-foot stroke.

Can be seen at the plant of

The Ohio Iron & Steel Co.,

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by whom it is offered for sale.

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Improved Lathes,
Improved Planers,
Improved Milling Machines,
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Improved Shapers,
Etc., Etc., Etc.

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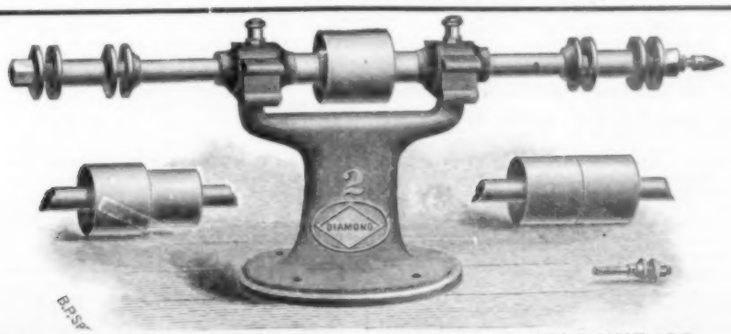

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Siemens-Martin Furnace Outfit—consisting of one ten-ton Siemens-Martin Furnace, Gas Producers, Store-Houses, Laboratory, Private Water Supply, etc., on thirteen acres extending from the Cleveland Terminal & Valley R. R. to the Cuyahoga River, at Brooklyn Station, on said railroad adjoining Cleveland. Easily reached by a spur from the Cleveland, Canton & Southern Belt Line, securing competitive rates. Will be rented low to a good tenant.

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Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.
U. Baird Machinery Co., Pittsburg, Pa.

Plates—
Pittsburg Steel & Iron Mfg. Co., Pittsburg, Pa.

Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.

Portable Drills—
C. H. Haeseler & Co., Philadelphia, Pa.

Power Presses—
Springfield Machine Tool Co., Springfield, O.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
Cady Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.

Presses—
Springfield Machine Tool Co., Springfield, O.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.

Pulley Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Pumps (Steam)—
W. G. & G. Greenfield, East Newark, N. J.
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Pump Regulators—
Valley Iron Works, Williamsport, Pa.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Rock Breakers—
American Hoist & Derrick Co., St. Paul, Minn.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

Rolls—
Samuel Tretheway & Co., Pittsburg, Pa.

Roofs—
Berlin Iron Bridge Co., East Berlin, Conn.
The Cincinnati Corrugating Co., Piqua, O.

Roofing Plates—
Morton Tin Plate Co., Cambridge, O.
The Cincinnati Corrugating Co., Piqua, O.

Rust Preventatives—
Otto Goetze, New York City.

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The Lloyd-Booth Co., Youngstown, O.

Sand Blast Machines—
Ward & Nash, Chicago, Ill.

Saws—
Peter Gerlach & Co., Cleveland.

Schools—
International Correspondence Schools, Scranton, Pa.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
American Tool Works, Cleveland, O.

Semi-Steel—
McDowell Steel Co., Chicago, Ill.

Shapers—
Springfield Machine Tool Co., Springfield, O.

Shafting—
Finished Steel Co., Youngstown, O.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Berger Bros., Philadelphia, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

Smoke Consumers—
American Smokeless Furnace Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.

Stacks—
Wm. B. Scaife & Sons, Pittsburg, Pa.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Vulcan Iron Works Co., Toledo, O.
Vulcan Iron Works, Chicago, Ill.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New York, N. Y.
The Johnson Co., Johnstown, Pa.
Potter & Hollis Foundry Co., Chicago, Ill.
McDowell Steel Co., Chicago, Ill.

Steel Knives—
Samuel Tretheway & Co., Pittsburg, Pa.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.

Steel Stamps and Stencils—
J. H. Flecharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O.

Steel Tanks—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Berlin Iron Bridge Co., East Berlin, Conn.

Stokers—
Playford Stoker Co., Cleveland, O.

Structural Engineers—
Berlin Iron Bridge Co., East Berlin, Conn.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Central Iron & Steel Co., Brazil, Ind.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

Telephones—
Universal Telephone Co., Indianapolis, Ind.

Time Detector—
Nana & Co., New York.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Gummey, McFarland & Co., Philadelphia, Pa.
Morton Tin Plate Co., Cambridge, O.
Atlanta Steel & Tin Plate Co., Atlanta, Ind.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

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Dangler Stove & Mfg. Co., Cleveland, O.

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Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

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S. Fix Sons, Cleveland.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Valves—
C. H. Besly & Co., Chicago, Ill.

Ventilating Fans—
American Blower Co., Detroit, Mich.

Watchman's Time Detector—
Nanz & Co., New York.

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Cornelius S. Mitchill, New York City.

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Lansing Wheelbarrow Co., Lansing, Mich

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Salem Wire Nail Co., Salem, O.

Wire Rope—
American Hoist & Derrick Co., St.
Roberts Steel Chain Belting Co., Pittsburg.

Wire Machinery—
Cady Mfg. Co., Cleveland, O.
John Adt & Son, New Haven Conn.

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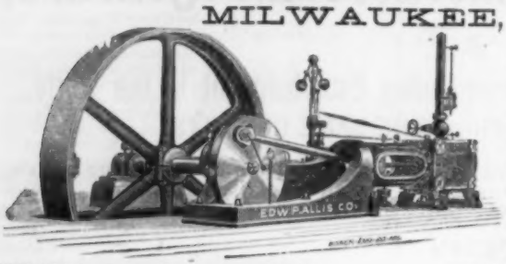
MILWAUKEE, WIS.



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Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

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PITTSBURG, 702 German National Bank Bldg.
SALT LAKE CITY, Desert Bank Bldg.
KANSAS CITY, Armour Bldg.

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The Iron Trade Review.

$3.00 Per Year.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@ 5.00
No. 1 Bessemer hematite	3.75@ 4.25
Hematites No. 1 non-Bessemer	2.25@ 2.75
No 1. Specular, non-Bessemer	2.75@ 3.25

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$13 25
No. 1 Strong Foundry	13 75@ 14 00
No. 2 Strong Foundry	13 00@ 13 25
No. 1 Gray Forge, red short	11 50@ 11 75
No. 2 Gray Forge, neutral	11 00
No. 1 American Scotch	14 00
No. 2 American Scotch	13 50@ 13 75
Lake Superior Charcoal	14 25@ 15 25

PITTSBURG:

No. 1 Foundry	$13 50@ 13 75
No. 2 Foundry	13 00@ 13 25
Gray Forge	11 25@ 11 50
White and Mottled	11 00@ 11 25
Warm Blast Charcoal	15 50@ 16 50
Cold Blast Charcoal	20 00@ 22 00
Bessemer	13 00@ 13 25

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	12 75@ 13 25
Local Coke Foundry No. 2	12 25@ 12 75
Local Coke Foundry No. 3	11 25@ 11 75
Local Scotch Foundry No. 1	12 75@ 13 25
Local Scotch Foundry No. 2	12 25@ 12 75
Local Scotch Foundry No. 3	11 25@ 11 75
Southern Coke No. 1	12 60@ 12 85
Southern Coke No. 2	12 10@ 12 60
Southern Coke No. 3	11 60@ 12 10
Southern No. 1 Soft	12 10@ 12 60
Southern No. 2 Soft	11 60@ 12 10
Southern Silveries No. 1	12 75@ 13 00
Southern Silveries No. 2	12 25@ 12 75
Jackson Co. Silveries	14 50@ 16 00
Ohio Silveries No. 1	15 00@ 15 50
Ohio Silveries No. 2	14 50@ 15 00
Ohio Strong Softeners	15 00@ 15 50
Alabama Car Wheel	17 50@ 18 00
Malleable Bessemer	13 75@ 14 00
Coke Bessemer	13 75@ 14 00

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$11 50@$11 75
Southern Coke No. 2 and No. 1 Soft	10 75@ 11 25
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	13 50@ 14 00
Jackson County Silvery No 1	14 00@ 14 50
Southern Coke, Gray Forge	10 00@ 10 25
" " Mottled	9 75@ 10 00
Standard Alabama Car Wheel	15 75@ 16 25
Tennessee " "	14 50@ 15 00
Lake Superior " "	15 75@ 16 25

BUFFALO (reported by Rogers, Brown & Co.)

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$13 50
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 00
Ohio Strong Softener No. 1	13 70
Jackson Co. Silvery No. 1	15 25@ 15 75
Lake Superior Charcoal	14 00@ 15 00
Southern Soft No. 1	12 90
Hanging Rock Charcoal	18 00

ST. LOUIS (reported by Rogers, Brown & Meacham):

Southern Coke No 1	$12 00@12 25
Southern Coke No. 2	11 50@ 12 00
Southern Coke No. 3	11 25@ 11 50
Southern Gray Forge	10 50@ 10 75
Southern Charcoal No. 1	14 50@ 15 00
Missouri Charcoal No. 1	14 00@ 15 00
Ohio Softeners	16 00@ 17 00
Lake Superior Car Wheel	17 00@ 17 50
Southern Car Wheel	16 50@ 17 00

OLD RAILS AND SCRAP METAL.

	GROSS TONS
Old iron rails	$17 00
Old steel rails	12 50
Old car wheels	13 00
	NET TONS
No. 1 R. R. wrought scrap	$12 00
Mill scrap	9 50
No. 1 Machine cast scrap	10 00
Iron axles	16 00
Axle turnings	9 00
Wrought turnings (free from cast)	8 50
Cast borings	7 50
Uncut wrought iron boilers	5 00
Steel boiler plates	10 00
Grate bars	6 50
Pipes and flues (clean)	8 50
Tank iron	9 00
Hoop and band iron	7 00
Sheet iron	6 50
Wrought drillings	7 50
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.49c@1.54c
Angles	1.34c@1.39c
Tees	1.49c
Universal Plates	1.45c
Sheared Plates	1.55c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 60
1½ to 6 by ⅜ to 1 inch	1 65
1¾ to 6 by 1⅛ to 2 inch	1 65
1¾ & 1⅞ by ¼ to ¾ inch	1 40
1 & 1⅛ by ¼ to ¾ inch	1 50
⅛, ¾, ⅞, by ¼ to ⅝ inch	1 60

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas
THE CADY MFG. CO.
18, 20 and 22 Johnson St., CLEVELAND, O.

SEND FOR OUR NEW CATALOGUE OF Power Presses, Drop Hammers, Punches and Shears, Wire Working and Special Machinery.

PERFORATED METALS
OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS

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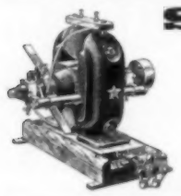
MANUFACTURERS OF HIGH GRADE **FIRE BRICKS**
PITTSBURG, PA.
Works and Mines, Westmoreland, Pa.

DIXON'S GRAPHITE PAINT
FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL. Tin roofs well painted have not required repainting for 10 to 15 years.
If you need any paint it will pay you to send for circular.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.



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FOR INCANDESCENT LIGHTING IN FACTORIES AND MILLS.
We Are Making a Specialty of 30-Light Machines,
But have Larger and Smaller Sizes.
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POWER From **GAS OR GASOLINE.**
No Steam, Coal, Ash, Gauges, Engineer nor Danger.
From 1 to 250 horse-power. } Can be Used in City or Country.
THE OTTO GAS ENGINE WORKS, Inc.
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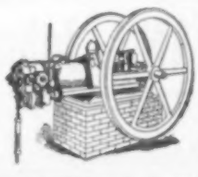

IRON CLAD PAINT CO.
Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.
IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅞ inch	1 40
2 to 2⅝ inch	1 60
2¾ to 3¾ inch	1 55
3⅞ to 4 inch	1 90
4⅛ to 4⅝ inch	2 50
4¾ to 5 inch	2 70

Oval.

⅜ to 1¾ inch	1 60
⅜ to ¾ inch	1 60
½	1 80
⅝	2 00

Half Oval and Half Round.

1½ to 3 inch	1 95
⅞ to 1½ inch	1 75
⅞ to ¾ inch	2 00
½	2 15
⅝	3 75

Heavy Band.

1¼ to 6 by ⅛ and 5-16 inch	1 50
1 to 1⅜ by ¼ and 5-16 inch	1 55
¾ to ⅞ by ¼ and 5-16 inch	1 65
½ to ⅝ by ¼ and 5-16 inch	1 90

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 75
1 7-16 to 2, No. 17, 18 and 19	1 85
1 7-16 to 2, No. 20	1 90
1 7-16 to 2, No. 21	2 00
1 7-16 to 2, No. 22	2 10
1⅝ to 1⅜, No. 13, 14 and 15	1 80
1⅝ to 1⅜, No. 16, 17 and 18	1 85
1⅝ to 1⅜, No 19 and 20	1 90
1⅝ to 1⅜, No. 21	2 00
1⅝ to 1⅜, No. 22	2 10
15-16 and 1 inch, No. 13, 14 and 15	1 75
15-16 and 1 inch, No. 16, 17 and 18	1 90
15-16 and 1 inch, No. 19 and 20	2 00
15-16 and 1 inch, No. 21	2 10
15-16 and 1 inch, No. 22	2 20
⅞, No. 13, 14 and 15	2 00
⅞, No. 16, 17 and 18	2 10
⅞, No. 19 and 20	2 20
⅞, No. 21	2 30
⅞, No. 22	2 40
13-16, No. 13, 14 and 15	2 10
13-16, No. 16, 17 and 18	2 20
13-16, No. 19 and 20	2 30
13-16, No. 21	2 40
13-16, No. 22	2 50
¾, No. 13, 14 and 15	2 20
¾, No. 16, 17 and 18	2 35
¾, No. 19 and 20	2 45
¾, No. 21	2 55
¾, No. 22	2 65
11-16, No. 13, 14 and 15	2 45
11-16, No. 16, 17 and 18	2 50
11-16, No. 19 and 20	2 60
11-16, No. 21	2 70
11-16, No. 22	2 80
11-16, No. 23	2 90
⅝, No. 13, and 15	2 50
⅝, No. 16, 17 and 18	2 60
⅝, No. 19 and 20	2 70
⅝, No. 21	2 80
⅝, No. 22	2 90
⅝, No. 23	3 00
9-16, No. 13, 14 and 15	2 70
9-16, No. 16, 17 and 18	2 80
9-16, No. and 20	3 90
9-16, No. and	2 00
9-16, No. 221	3 10
9-16, No. 22	2 20
7-16 and ½ inch, No. 13, 14 and 15	3 90
7-16 and ½ inch, No. 16, 17 and 18	3 00
7-16 and ½ inch, No. 19 and 20	3 10
7-16 and ½ inch, No. 21	3 20
7-16 and ½ inch, No. 22	3 30
7-16 and ½ inch, No. 23	3 40
⅜, No. 13, 14 and 15	3 40
⅜, No. 16, 17 and 18	3 50
⅜, No. 19 and 20	3 60
⅜, No. 21	4 90
⅜, No. 22	4 00
⅜, No. 23	4 15

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 60
1⅝ to 6 by Nos. 11 and 12	1 65
1 to 1⅜ by ⅛ to 3-16 inch	1 65
1 to 1⅜ by Nos. 11 and 12	1 70
⅞ and 13-16 by ⅛ to 3-16 inch	1 80
⅞ and 13-16 by Nos. 11 and 12	1 75
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	1 80
⅛ inch, " " " " 13 and 14	1 90
¼ inch, " " " " 11 and 12	1 95
¼ inch, " " " " 13 and 14	1 35

Sheet Iron.

No. 10	1 62
No. 12	1 70
No. 14	1 80
No. 15-17	1 50
No 18	2 65
No. 20	2 20
No 22-24	2 30
No. 25 26	2 40
No 27	2 50

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 63
Flange	1 70
Marine Flange	2 00
Fire Box	2 50
Above includes plates 90 inches wide	
90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	08
9-16 to ⅞ in. "	08

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TIN AND TERNE PLATE, Iron and Steel Plates and Sheets, Plain Black, Painted, Corrugated and other forms of ROOFING, SIDING and CEILING. Patent Leveled Galvanized Sheets, BARS, Light Section Rails, ANGLES, Tees, Channels, and other Miscellaneous Bars and SHAPES.

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POCAHONTAS FLAT-TOP COKE.

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Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

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L. M. MOYES, MANUFACTURER, PHILADELPHIA, PA.

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7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅛	.10
⅛ to 6 in.	.10½
⅛ to 9-32 and 6⅛ to 7 in.	.11
7 to in.	.13

Flats.

	cts. ℔s
2 to 9-16 in. wide by 2 to ⅛ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 80
Open-hearth Spring	"	2 20
Sleigh Shoe	"	1 90
Toe Calk	"	2 10
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " "	dis. ;
Lap " galv. "	dis. 52½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis. 62½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1⅛"	dis 50&10
Morse Taper and Straight Shank Larger than 1⅛"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

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Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:30 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:10 am	* 5:45 pm
Akron and Columbus	* 8:10 am	*5:45 pm
Akron, Columbus & Zanesville	†12:45 pm	†12:10 pm
Columbus and Cincinnati	* 8:00 pm	* 7:30 am

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Valley Jctn. & Way Stations	*6:30 P M	*7:10 A M
Akron, Canton & Valley	*10:10 A M	*3:15 P M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Akron, Canton & Worcester, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:55 P M	†11:00 A M

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	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F. F. FF.
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

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Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 55
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@70
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 65@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs 12c
" " " " over 5 lbs 10c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5¾	4¾	4	3¾	3⅛
Hexagon	15⅜	11⅛	8¾	6	5⅛	5¼	
Washers	9	8	7	5	4⅜	4½	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887 ..... dis 80
Standard Penny Nails, ₩ keg card rate
Car lots $2 75
Less than car lots $2 75

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz ..... dis 10@10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Pulleys.

Iron Pulleys, Walker List ..... dis 50
Medart Pulleys ..... dis 50
Split Wood Pulleys ..... dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block ..... dis 20

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in ..... is 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2¾ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 4c
Copper ..... dis 4c
Bright and annealed, Nos 0@18 ..... dis 70&10&75
" " Nos. 19@26 ..... dis 75@75&5
" " Nos. 27@36 ..... dis 75&10&5
Coppered Nos. 0 to 18, market list ..... dis 70@70&5
Galvanized Nos. 0 to 18 " " ..... dis65&5
Tinned market Nos. 0 to 18 ..... dis 67½
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&5@70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... 95c ₩ lb dis 30

Wrenches.

Coe's genuine ..... dis 50
Girard Standard ..... dis 70&10
Agricultural ..... dis 75&10
Mechanic's ..... dis 55&10&5
Bemis & Call's Combination ..... dis 35
Donohue's Engineers ..... dis 20&10
Lamson & Sessions Engineers ..... dis 60
Billings & Spencer's Drop Forged ..... dis 25
William's " " ..... dis 25
Alligator " " ..... dis 40

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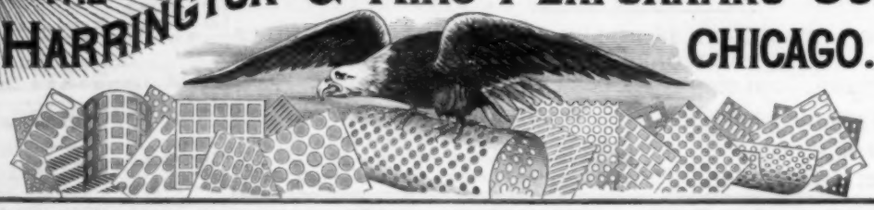

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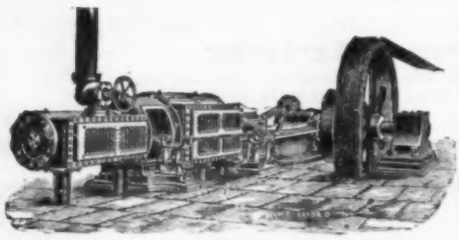

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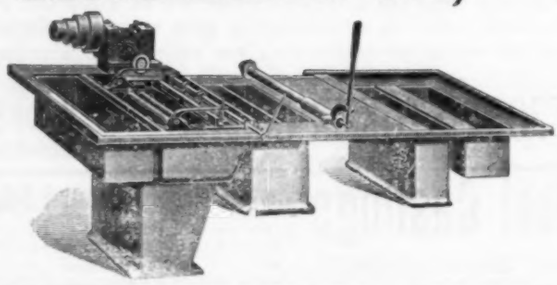

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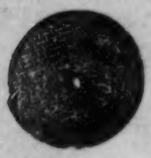

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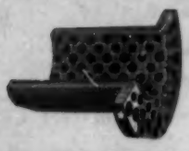

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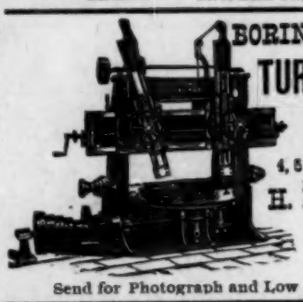

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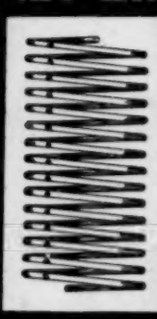

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